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Preface

For the twenty-sixth year, the Research and Theory Division of the Association for Educational Communications and Technology (AECT) is sponsoring the publication of these Proceedings. This is *Volume #2 of the 26th Annual Proceedings of Selected Papers On the Practice of Educational Communications and Technology* presented at the National AECT Convention in Anaheim, CA. Copies of both Volume #1 and Volume #2 were distributed to Convention attendees on compact disk. Volume #2 is also available on microfiche through the Educational Resources Clearinghouse (ERIC) System.

This volume contains papers dealing primarily with instruction and training issues. Papers dealing with research and development are contained in the companion volume (26th Annual, volume #1) which also contains over 60 papers.

REFEREEING PROCESS: Papers selected for presentation at the AECT Convention and included in these Proceedings were subjected to a reviewing process. All references to authorship were removed from proposals before they were submitted to referees for review. Approximately fifty percent of the manuscripts submitted for consideration were selected for presentation at the convention and for publication in these Proceedings. The papers contained in this document represent some of the most current thinking in educational communications and technology.

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Solving on-the-job problems in modern work environments: Using Electronic Performance Support Systems

Omur Akdemir
Syracuse University

Abstract

Electronic Performance Support Systems (EPSS) have opened a new avenue for instructional designers. Organizations quickly understood their values and started to get benefit of using EPSS to solve on-the-job problems. This paper provides a brief overview of the EPSS and illustrates the advantages of using EPSS in modern work environments.

Introduction

The world is changing faster than ever before. Especially developments in computer technology accelerate this change. Corporations are faced to integrate new technologies faster to survive in today's corporate environment. This requires their employees to learn the operation of more complex products. As a result of this process of change, employees must maintain current levels of operational effectiveness while learning and retaining new complex processes and skills. In the context of changing environments, many employees are becoming multifunctional. Employers expect their employees to do many more tasks at irregular intervals (Spaulding & Dwyer, 1999). Thus, training becomes inevitable for organizations whose employees use new products. Many organizations devote their valuable time to train their employees. There is no doubt that spending time for training improves productivity if the training is designed and implemented properly. However, organizations loose money and workforce when their employees attend training sessions.

Once upon a time, employees learned exclusively within actual job contexts while doing real work. In other words, they started performing simple tasks and progressed along the proficiency curve with personal and individualized guidance by an expert (Gery, 1991). Today's business world makes it impossible to organize and offer such a training approach because of the number of employees that need to be trained at a time. There is no way to find this number of experts for each trained employee. Moreover, every new introduced product has many features and even after the training many of them, if they are not practiced regularly, have a risk to be forgotten.

Electronic Performance Support Systems (EPSS) have opened a new avenue for instructional designers. Organizations quickly understood their values and started to get benefit of using EPSS in their organizations to solve on-the-job problems. The foundations of EPSS are in fields such as cognitive psychology, instructional design, and interface design. The late 1980s witnessed emerge of EPSS in business to enhance performance in complex and changing environments and to respond to concerns regarding the cost effectiveness of training (Chiero, 1996). This paper provides a brief overview of the EPSS and illustrates the advantages of using EPSS in modern work environments.

What is EPSS?

The EPSS have different names including Integrated Performance Support, Automated Performance Support, Performance Support Systems, and Performance Support Tools. Even though the labels are different, the purpose is the same: to improve performance in the work environment. According to Miller (1996) "[a]*n electronic performance support system is any computer software program or component that improves employee performance by either:*

Reducing the complexity or number of steps required to perform a task (process simplification),

- *Providing the performance information an employee needs to perform a task, or*
- *Providing a decision support system that enables an employee to identify the action that is appropriate for a particular set of conditions" (p.2).*

Where does EPSS fit?

Before attempting to explain EPSS, it is beneficial to first look at where EPSS fit under the umbrella of technology-based learning solutions. The IBM e-learning model helps to find where EPSS fits within the technology-based training solutions.

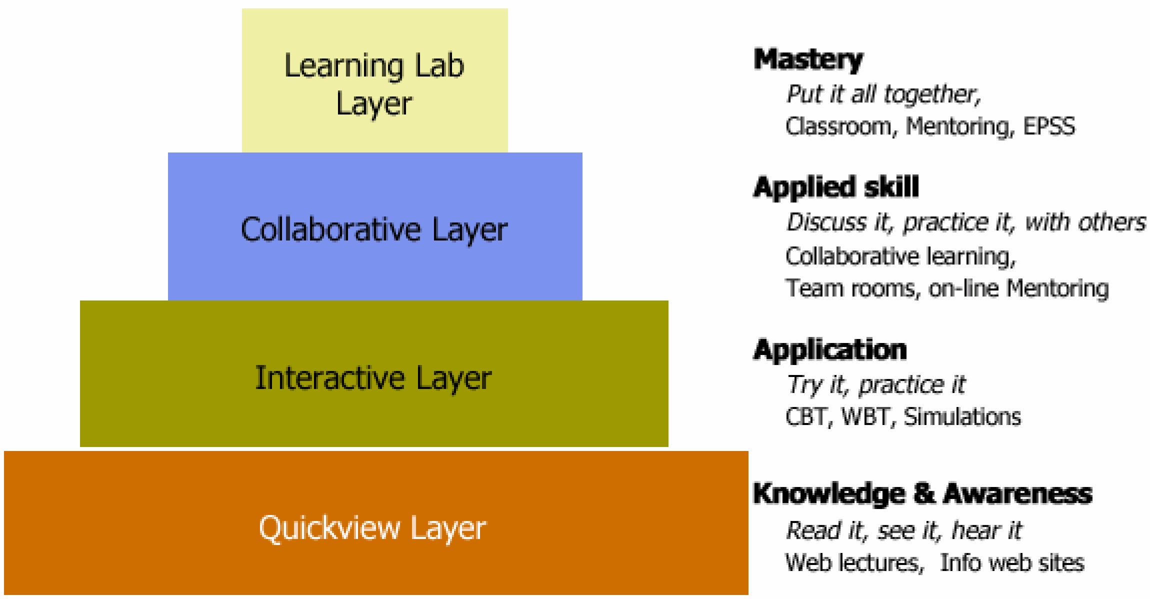

Figure 1. The IBM e-learning model suggested by MacEke (2000)

EPSS takes place at the Mastery level, which encompasses all other three levels, knowledge & awareness, application, and applied skill. Learners perform all the requirements of these three sub-levels. They read, see, hear, try, discuss, and practice. EPSS can provide activities, practices, and simulations, each of which reflects the context in which the learner invokes the component. This component is usually a type of computer-based or intelligent computer-assisted instruction with small modules that provide instruction related to a specific piece of the performance (Chiero, 1996).

Why EPSS?

According to MacEke (2000) "the focus is less on getting people in traditional classes than it is about…

- Increasingly embedded learning in business processes and initiatives
- Increasing overall productivity and competitiveness
- Leveraging learning solutions as a way to solve problems
- Facilitating the transfer of knowledge"

Based on this trend, it could be said that organizations are looking for a way to improve productivity when their employees are still working rather than attending traditional face-to-face training. In other words, organizations want their employees to perform certain tasks when they are required. It is obvious that if these tasks are performed in certain periods of time, learning inevitably occurs. By doing this, organizations are able to keep their employees in their work environment and help them to solve on-the-job problems when employees encounter them. Since the primary purpose of electronic performance support systems is to improve productivity by providing help to perform specific tasks, EPSS has become the popular way to solve on-the-job problems.

Advantages of EPSS

The main purpose of the all-training activities is to have people perform certain tasks. Training designers expend effort to reach this goal. However today's work environments require too many tasks that need to be performed. Training at one point becomes not the solution. Even well designed training sometimes does not reach its aim. There are different reasons why training does not become the solution and as a result EPSS are preferred.

The complexity of the task is one of the reasons. Organizations frequently are increasing their expectations of their employees. One employee has to perform too many tasks, so employee has to learn these tasks first. However, because of the complexity of the tasks, it is difficult to memorize the necessary steps and perform them in a correct order. It is often desirable and possible to improve performance without necessarily promoting learning, to create expertise without necessarily creating an expert (Rosenberg, 1995). EPSS allows employees to access necessary information when it is required in the work environment, so employees do not need to worry about the complexity of the tasks.

When EPSS are used to minimize rote learning, information overload for workers is reduced. Using EPSS also allow workers to concentrate on higher cognitive processes (Gilbert, 1998). This increases the self-confidence of employees and as a result the productivity of the work done.

The tasks are constantly being changed. Thus, employees have to adapt themselves these changing tasks. Training programs are organized to facilitate the adaptation process of employees to the recently introduced tasks. Since employees often do not perform tasks frequently, the knowledge and skill they learn in training have a risk to be easily forgotten. To really acquire and master a skill, it is not sufficient to simply listen to someone explaining it to you (MacEke, 2000). Thus, it is beneficial to master a skill when performing that skill. EPSS lets employees master certain skills while they are performing them in real work environments instead of attending training.

Perhaps one of the most important advantages of EPSS for organizations is that it reduces training expenses and the time spent for training employees. EPSS was developed by people look-ing for ways to impact performance directly, without the intermediate steps involved in instruction (Rosenberg, 1995). The technical advantages of delivering learning and performance support over an intranet include ease of distribution, ease of access, and use of existing infrastructure. These advantages offer immediate cost savings, as well as the promise of transforming work and learning as a result of increased connectivity (Gilbert, 1998). Consequently, organizations are able to save money because they do not need to organize training and so their employees do not need to attend training.

Conclusion

The complexity of the business world makes competition between companies more challenging. Companies have to adapt themselves to the changing world more rapidly than ever before. As a result of this changing world, the work environments have been changed rapidly. The faster the employees adapt these changing work environments, the more success companies will achieve. Traditional training methods sometimes do not alleviate the workload of training designers who help employees to adapt themselves to the changing work environment and tasks. EPSS have opened a new avenue for the designers to support on-the-job performance. Using EPSS offers several benefits. Employees can perform complex tasks without necessarily learning them. EPSS minimize rote learning and employees can consecrate on higher-level cognitive processes. Finally EPSS impact performance without the intermediate steps involved in instruction.

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Time to Learn: The Use of Institutes in the Development of Faculty Technology Skills

Cheryl A. Anderson
University of the Incarnate Word

Institutions large and small are struggling to find successful ways to encourage faculty to build technology into the curriculum. Kenneth C. Green, Director of the Campus Computing Project, reports that institutions consider the challenge of supporting faculty in the integration of technology in teaching to be the highest priority. He states, "Roughly one-fourth (24.3 percent) of the 2002 survey respondents cite instructional integration as the key IT issue for their institutions in the coming years (compared to 31.5 percent in 2001, 40.5 percent in 2000, and 29.6 in 1997)" (Green, 2002, p 25). Administrators of information technology rank "faculty development, support and training" as being among the top ten institutional strategic issues facing institutions of higher education. (Kobulnicky, Rudy, et. al, 2002). According to these researchers, understanding faculty culture is essential in the creation of successful faculty development programs.

Unfortunately, faculty members face many barriers to the use of instructional technology. Butler and Sellbom (2002) found that the unreliability of technology; the time it takes to learn to use technology; questions about instructional appropriateness; and lack of support from the institution cause faculty to turn away from its use. In support of these findings, the presenter (Anderson, 2002) has found that faculty rank time to plan for technology to be a major hurdle for not using it at University of the Incarnate Word (UIW). In 2001, 53 percent of respondents to a survey on technology needs identified time as the primary reason for not using technology. More than one-third (37%) of the respondents cited limited access to equipment; and less than 10 percent identified lack of information about technology and being uncomfortable with technology barriers to technology use.

Although UIW Office of Instructional Technology (OIT) offers workshops during the school year, the number of faculty participating in these sessions has not been excessive. This is due to a four-course workload requirement for faculty and their obligation to participate in committee work. It makes it difficult for faculty to find the time to participate in training. In response to faculty reported needs, the OIT staff implemented a technology-training program, which targets the barrier of time. The training strategy is to provide intensive, hands-on Technology Institutes during times of the year when faculty members have either a light teaching load or none at all. The first two-week institute was started in the summer of 1998 with a limited budget of $10,000. With the financial assistance of a Title V Hispanic Serving Institution grant awarded in 1999, the program has been expanded to include a Winter and Summer Institute. Two levels of training have been developed. With the implementation of the course management system Blackboard, a seminar in online pedagogy has been added.

The goals of the training program are to have each faculty member create an instructional product using various media; create a collaborative learning environment among the faculty and the instructors; develop in faculty an awareness of UIW technology resources including equipment and human resources; have faculty learn to play, create and problem solve using technology; and to develop within each participant a level of comfort and self-sufficiency with the technology. Since 1998, over 80% of the fulltime faculty members (total 135) have received training through this intensive, hand-on experience. As a result, the University has reached a critical mass of trained faculty, who are putting their technology skills to use in the classroom.

This paper will discuss the Technology Institutes in terms of the application process, format, content and evaluation. At the end, the author will make recommendations for other institutions looking for successful training strategies based on six years of experience. The results of several follow-up surveys which have been conducted with faculty one-year after their institute experience to determine what progress they have made with regard to integrating technology in their classroom teaching will be presented.

Technology Institute participants are selected in a competitive process. In a two-page application, applicants must describe their interest in learning new technology skills and the anticipated impact of the skill development on classroom teaching and their particular academic program. They must identify an instructional problem that can be addressed using technology. Finally, their Deans must provide a recommendation. Only 10 faculty are selected for the Basic Training session and 8 are selected for the Advanced Training. The juried selection process makes attending the institute "special" for participants; and as a result, many faculty highlight it in their annual performance reviews.

Training in the summer is two weeks and the winter session is compressed into six-day period before the second term. A combination of lectures, demonstrations and hands-on practice is used to cover the curriculum. Although they have taught for years, many faculty have little formal training in instructional design so this is covered in the first day of class. Faculty are asked to identify a problem and an audience, write instructional objectives, create an outline and select a media before they start their project. Storyboard techniques are discussed and participants are required prepare a storyboard of their project by the end of the first week. The curriculum also introduces graphic design and web page design concepts. In addition, the trainers have created practice exercises for each piece of software used and faculty are given reference books as reinforcements.

The last half of the training is dedicated to producing media projects. During the summer faculty may choose to do a Microsoft PowerPoint™ presentation or do a web site using Microsoft FrontPage™, depending on their own interests and comfort level with the technology. In the winter training, they create a project with both packages. The participants are required to discuss their projects with their colleagues using their storyboards. Then, each participant is expected to spend time during and outside of class developing a final product. The trainers work one-on-one with the faculty in helping to solve technical problems. In addition, the faculty help each other as they work through difficulties.

On the final day of the institute, each participant is given time to display his or her project for their colleagues. When the showcase is complete, the participants vote for the works that demonstrate the "best of" in a number of categories. The institute closes with a luncheon and the awarding of certificates.

Due to faculty requests, in the summer of 2001, the OIT opened an Advanced Technology Institute. It uses a similar two-week format. The application process is the same as with the basic training, which is a pre-requisite for the advanced training. The curriculum is different and more challenging. Participants learn to use Toolbook Instructor II, Sound Forge, Photoshop and a digital video editing system called Dazzle. Instead of working on individual projects, the participants work in two groups of four people. Each group puts together a multimedia tutorial that has already been scripted and storyboarded. The graphics and video clips have been prepared ahead of time. The task is to pull it all together into an 80-slide tutorial. Participants must learn to use Toolbook's Action Editor to make the tutorial interactive. They record music and narration and edit the video into a small movie that is into the tutorial. The team approach allows the group to finish the project within two weeks. Faculty can focus on learning the multimedia tools rather than worrying about the content. By sharing the workload, participants with weaker skills can lean on faculty with stronger technology skills to get the work accomplished.

Faculty rewards have been an important part of the training program. For the first two years, the institute could only afford to give participants small tangible rewards like books, T-shirts, certificates and luncheons. The biggest reward for the first two years was a digital camera for each faculty member. The limited TI budget ($580 per person) did not make it possible to compensate faculty for their time. Faculty were allowed to spend $150 on a piece of hardware or software of their own choosing. In evaluations, faculty were overwhelmingly positive towards these small benefits. The University received a Title V Grant for Hispanic Serving Institutions in 1999 that provided, in addition to the standard rewards, a $1,000 stipend for each faculty member. We also purchase $500 worth of hardware or software for each participant.

The addition of the Title V money certainly has peaked faculty interest in the TI, but so has the quality of the experience. The OIT has conducted evaluations each year that show the faculty's overall reaction to the institute as being very positive. All of the participants have stated that they would "highly recommend" the experience to a friend. In a 2003 Technology Needs Assessment of fulltime faculty, 52% indicated that having an opportunity to participate in the Technology Institutes was most beneficial to their learning about technology.

For the past three years, the Title V office has done a follow up survey with former Technology Institute participants approximately one year out from their institute experience. The purpose is to find out how their participation in the institute has affected their teaching practices with technology. In the most recent follow up, 25 participants in the 2002 Institutes were surveyed using multiple answer and open-ended question instrument. The response rate was 64%. Forty-four percent of the respondents indicated that they were using technology more than before the institute and 50% responded that they were using it somewhat more and no one indicated their use was less. In addition, 81% indicated they were using PowerPoint and 75% were using Blackboard in their courses. Faculty indicated that they were assigning students to use the Internet (81%) and other software (50%) as part of class. In addition, 69% indicated that they had taught students to use technology needed for class. When asked about what their reasons were for NOT using technology this year, only 12% of the respondents indicated that they had a concern about the compatibility of using technology with their course content. The number one reason was that they were too busy with other work (50%). However, faculty remain interested in learning more about technology in that 62% indicated that they had attended a campus technology workshop, 44% had given a conference presentation using technology and 31% reported that they were using technology to conduct research.

When asked if the TI experience had changed their practices with technology for the better responded, one faculty member stated, “I have seen a definite change in the way I use technology. I am not skeptical about investigating and showing others how to use technology even if I make an occasional mistake. I am not afraid of technology anymore.” Another stated, “My level of comfort in using technology in the classroom has increased considerably; and I believe this has been transferred to my advisees and other students.” These are all indications that faculty who attended the training come away feeling more comfortable with the technology and are integrating what they have learned into their teaching practices.

The evaluation results have reinforced our belief that UIW has developed a winning strategy for technology skill development. As of the summer of 2003, 110-fulltime faculty have been through Technology Institutes. This training has changed how faculty use technology in teaching.

It does take hard work to put together a program such as UIW's Technology Institute. It can be done even on a limited budget. Our recommendations for other institutions of higher education thinking about faculty training are these.

1. Plan an institute during the time periods where the workload is lighter for faculty or during times in between semesters.
2. Formalize the application process; make it competitive and peer reviewed for added value;
3. Keep the classes small, more than 10 participants cuts down on individualized attention;
4. Model the behavior by using multimedia to teach faculty the skills;
5. Change the technology with the times and teach the most current version of the programs;
6. Give the participants copies of the software for their office so that once they learn to use it, they have ready access to it;
7. Do not under estimate the little rewards such as T-shirts, lunches and books;
8. Give faculty something that they would never buy themselves such as a digital camera;
9. Hire trainers who are patient, helpful and sensitive to the vulnerability of a faculty member who has a doctorate but who cannot right click a mouse;
10. Have people on staff who can support the faculty after the workshop, and
11. Evaluate the workshops and conduct follow up evaluations so improvements can be made to the program.

Finally, the OIT staff has come to realize that the greatest benefit for the participants of this institute is that it energizes faculty. It makes them feel more positive about their work and it gives them an appreciation of what it is like to be a beginner -- a learner. Most faculty have been experts in their field for years. Such an experience can make them more sensitive to their own students' needs. As one faculty put it so eloquently in her 1998 evaluation, "This program expanded my knowledge of the 'mystery' of technology as well as the vast potential available for teaching! However, this experience also made me realize once again some of the challenges my students face in every class. In other words, learning became real once again."

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Blending Multiple Perspectives for Evaluating Web-Based Learning

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Evaluation is a critical component to the success of all instructional systems. Traditionally, the evaluation process is used to identify strengths and weaknesses in instructional content (e.g., activities) by assessing outcomes such as the alignment of the content and instructional goals and objectives with one another. In organizations, evaluation of Web-based training ensures that goals and objectives are met, that learners acquire knowledge and skills from the content and that they can apply what they have learned to their job. In Web-based learning, it is also important to consider other factors that affect instructional content including the presentation of content (i.e., interface design and information architecture), clustering/grouping of content, and accessibility (including for people with disabilities) of information on the screen.

The fields of education, psychology and technology each offer models for evaluating Web-based learning, and each have a different focus. By combining the strategies from each discipline, the definition of evaluation is broadened to include user assessments (e.g., learner validation of content and system features, instructor review of content and system features) and subject matter reviews (e.g., content reviews by subject matter experts, system reviews by system engineers, interface assessments by interface experts). In this way, the evaluation process can be maximized to provide a more thorough assessment of the quality of Web-based training in organizations from a learner, subject matter expert, and system perspective. Organizations can benefit from considering these multiple perspectives since this holistic approach is more likely to uncover what is effective and not effective in the training so that resources for revising training can be effectively targeted, and so that effective training programs continue to be developed.

Perspectives on Evaluating Web-Based Learning

To describe and eventually blend the three approaches, it is helpful to work from a common model in order to see differences among the perspectives. The educational approach will be used to anchor the discussion of the different approaches because it is the Analysis, Design, Development, Implementation and Evaluation (ADDIE) model, or variants of it that is commonly used to create instruction.

Educational Perspective on Evaluating Web-Based Learning

Evaluation from an educational perspective focuses on alignment of goals and objectives with what training is needed, and assessment of the content and activities to ensure they support the goals and objectives. The field of education presents a structure suggesting that evaluation be conducted during training design and development to ensure constant alignment of the content with goals and objectives, and after implementation to assess student learning and effectiveness of training materials. Specifically, most versions of the ADDIE model suggest a process during instructional creation so that after gathering needs for the training (from learners, supervisors and the organization) in the *analysis* phase, training content is *designed* (e.g., determining the cognitive level of learning, modules for the content) and *developed* (e.g., creation of content) and *evaluated* iteratively as "chunks" of training content are created. Once the training is complete and implemented, evaluation occurs again. While not all organizations do so, evaluating training throughout the instructional design process is important for assessing the congruence among content, goals, objectives and determining whether student learning occurred.

Focus of Evaluation

As demonstrated in the exhibit below, evaluation from an educational perspective occurs at several places within the ADDIE model's approach. As organizations design, develop and implement Web-based training, they may include a number of evaluation measures related to assessing return-on-investment, which is directly related to the quality of the training content. Evaluation during design and development – often called formative evaluation since it is conducted as the Web-based training is being "formed" or created – focuses on ensuring that content meets the goals of the course and the needs of the learners through learner validation and review of materials and activities by subject matter experts. Subject matter experts are guided during their evaluation by their understanding and experience with the content. Learners, on the other hand, are guided by the extent to which the content and activities facilitate their learning.

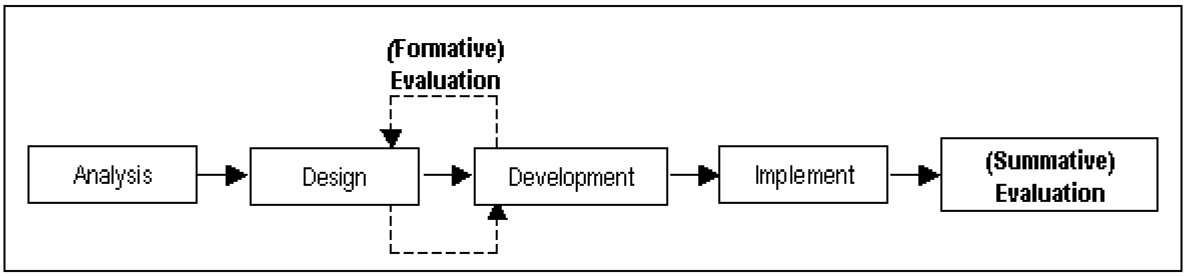

Figure 1. Educational Perspective: Analysis-Design-Development-Implementation-Evaluation Model with a focus on evaluation.

Training designers will create modules or lessons and have learners and subject matter experts review them prior to developing all of the training. This iterative process of design, development and evaluation not only reduces development costs, but also ensures that training content is constantly being adjusted as appropriate so that no major modifications will be needed after the entire training is developed. Training designers employ subject matter experts in the review of training goals and objectives, and assess the alignment of content and learner activities (e.g., facilitated chats, small group activities) planned with these goals and objectives. Subject matter experts also review student assessments to assess if they are measuring learning at the appropriate cognitive level (e.g., from knowledge-level or recall to problem-solving). Select learners within the target audience may be asked to review some materials and activities to ensure that the presentation of, and interaction with the content are interesting and relevant to them. The goal of formative evaluation from an educational perspective is to ensure accuracy and relevancy of the content, the inclusion of appropriate learner activities and assessments, and provide direction on changes needed to ensure training goals are met during training.

When educational evaluation occurs after implementation of the Web-based training, it is called summative evaluation. Generally, summative evaluation is conducted by outside evaluators who were not involved in the creation of the training. The focus is on assessing the training against the outcomes associated with the training.

Using evidence of student's achievement (e.g., portfolios, assessments, papers, quality and quantity of online discussions), evaluators assess whether the training goals and objectives were achieved, and make recommendations for improving the training.

In traditional educational environments, the ADDIE model works well and is fairly thorough. However, in web-based training environments, there are other factors that affect learning that should also be considered during evaluation such as the organizational impact of individuals who apply their training as examined from the perspective of psychology, and the human factors and system perspective of the technological perspective.

Psychological Perspective on Evaluation

The field of psychology also uses a structure for evaluating training outcomes. Kirkpatrick's four levels of training evaluation criteria exemplify the psychological perspective on evaluation which are: reaction, learning, performance, and results. The first level, *reaction*, refers to what a learner thought of their training experience. Kirkpatrick's second level, *learning*, refers to the measurement of knowledge, skills, and attitudes that were specified as training objectives. The third level, *performance*, refers to behavioral changes as a result of training. Finally, *results*, refers to the impact of the training on organizational objectives.

Evaluating these levels is important for measuring desirability of the learning environment, learning, performance on the job and organizational change as a result of training. For organizations, documenting these types of outcomes can provide information such as how best to improve a training course, evidence that training is working well and should continue, or evidence that the cost of training is outweighed by the impact of the results.

Focus of Evaluation

This type of evaluation is typically conducted immediately after training delivery (reactions and learning levels) or at some point thereafter (performance and results levels). This is shown as summative evaluation in figure 1. Evaluations from the psychological perspective are typically conducted by evaluators that did not develop the training. However, evaluations at the reaction and learning levels can be conducted by training developers or instructors. For each of the four types of outcomes there are specific questions that can be asked or data that can be gathered.

The focus during reaction measurement is to determine if there are aspects of the training that can be changed to better suit the learner, from the learner's perspective or the instructor's perspective. Reaction measures typically ask learners questions about their overall satisfaction, perceived usefulness of the content, satisfaction with the course process and reactions to different aspects of technology. This information is then used to make improvements to the course content and process that will improve satisfaction, learning, or retention of knowledge in future iterations of the course.

The purpose of measuring learning is to determine if the course objectives have been met and if the training is working as it was intended to work. Measures of learning typically assess the acquisition of knowledge and skills, or changes in attitude as a result of the training. These measures are typically administered upon completion of training, and can occur in a variety of forms such as a multiple choice knowledge test, hands-on testing, or measures of behavioral intentions. Information gathered about the learning that has taken place can be used to adjust course content to improve learning in future courses and to better facilitate transfer of training.

Performance as a result of training in organizations can most directly be measured by job performance. Job performance can be measured by supervisory assessments of performance related to training objectives or by more objective measures of performance such as changes in productivity. Evaluating the extent to which training has changed job performance is a means of determining if training transfer has taken place, and a direct, measurable indicator of the impact of training.

Results are usually organizational level outcomes. Results can be measured by such things as cost, turnover, absenteeism, accidents and morale as they relate to the goals of the training. Measuring the impact of training on factors such as these can lead to a direct translation of return on investment, as long as it can be determined that the impact on one of these factors is directly the result of training.

Evaluating each level is important for measuring desirability of the learning environment, the amount of learning that has occurred, the impact of the training on job performance and organizational change as a result of training. Evaluating training outcomes can enable an organization to document what is working well and what needs to be changed to better meet the goals and objectives of training. Evaluation from the psychological perspective addresses some important aspects of organizational training and can be tailored to address Web-based training, However, it does not capture many of the technological aspects of training that are addressed by the technological perspective of evaluation, nor does it implement an iterative evaluation during development such as those employed by both educational and technological evaluation.

Technological Perspective on Evaluation Evaluation from a technical perspective broadens the general definition of evaluation to not only include evaluation from a user (e.g., learner, instructor) perspective, but also from a system perspective (meaning testing the system to ensure functionality that supports the Web-based training) and interface perspective (to ensure that the way information is presented is usable). The software development life cycle is the generic model for approaching the creation and evaluation of Web-based training and other systems. It contains six basic steps conducted by instructional technologists and software design specialists (SDS) to build and assess the system including *analysis* (identifying organizational, instructor and learner needs for the software), *design* (layout of the pages and the architecture of the back-end systems that support it), *code generation*, *testing*, *release* (or implementation of the Web-based system) and *support*. These phases support the gathering of requirements for the Web-based training system, including database(s), interface(s), and design needed to support the online training.

Similar to the educational perspective, evaluation of the Web-based system throughout the creation of the training is important for assessing the congruence between the requirements gathered and the system that is built to support learning. In this way, the training can be built to better match the training goals, instructors and learners needs.

Focus of Evaluation Evaluation can only occur after a thorough gathering of software requirements in the analysis phase. The data gathered in analysis provides the measures against which all technological evaluation activities will occur. Next, organizations design Web-based training systems and generate the code that will support the learning environment, including test plan development, in order to assess the quality of the system as it relates to the requirements gathered. Figure 2 exemplifies evaluation throughout the SDLC process.

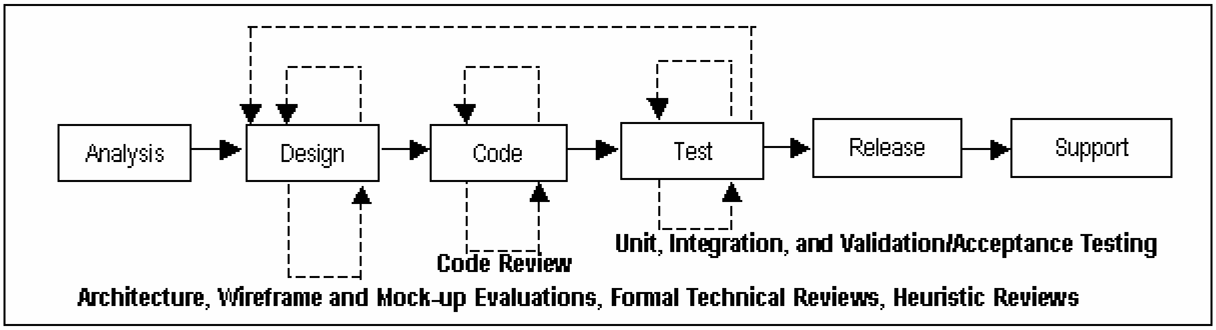

Figure 2. Technological Perspective. Software Development Life Cycle with a focus on evaluation.

Evaluation of the training by system design experts during the design phase focuses on ensuring that the system design and system architecture – or diagrams displaying the relationships among the database(s), interface(s), component(s), and other system(s) – are accurate according to the system requirements analysis phase. During this formal technical review, system design experts are guided in their evaluation by their understanding of the current systems' needs and their experience with similar systems.

Also in the design phase, interface designers begin laying-out the Web pages as wireframes. Wireframes are simplified outlines of pages describing the general location of the navigation, content and other features so the training content is presented consistently. Next, graphics designers begin creating images that are displayed on pages to create the look-and-feel of the training. These images will then be combined with the wireframes to create mock-ups, which are simplified HTML pages. During this process, a heuristic review takes place where wireframes and/or mock-ups are evaluated by outside interface design experts (who were not involved in the page designs) and by representative members of the target audience, including instructors and learners. Interface design experts are guided in their evaluation by the professional norms of interface design called heuristics, and instructors and learners are guided by their needs as they relate to the training.

These evaluation efforts reduce development costs as the system is validated by users (including instructors and learners) before investing money and time for programmers to generate code. The earlier that design flaws are identified, the easier they can be remedied, and the less the training system costs to build.

As the organization completes the design phase, the coding phase begins. Coding is the process of implementing the design including the interfaces, databases, and incorporation of other systems and components needed by the Web-based training. Systems designers, programmers and interface architects work together to create the training system, however the majority of the work is conducted by programmers as they follow the design (specified in the wireframes and mock-ups) and write code. During this phase, code reviews are performed by outside evaluators (i.e., systems designers and programmers) who were not involved in creating this particular training system. As components or "chunks" of the system are written, the code is reviewed for thoroughness and accuracy, but the code is not yet exercised.

This evaluation process is similar to the educational perspective wherein content is developed in modules and lessons, which are then reviewed by subject matter experts and learners before the entire training content is developed. Systems designers and programmers are guided in their evaluation of the code by the design established in the requirements documents, professional norms for writing code in various languages, and their experience with similar systems. Recommendations as a result of the code review are incorporated as coding continues. This iterative process continues until the coding for the Web-based training system is complete.

Finally, testing is a phase where the system components are evaluated, and then the components are assembled so that the entire system is evaluated. Three main types of testing occur in this phase: 1) unit testing, 2) integration testing and 3) validation/acceptance testing. Unit testing is conducted to determine the integrity of related chunks of code by exercising code at the smallest logical level or module. Programmers who were not involved in the creation of the system evaluate the units for logic errors, inefficiencies in code, and completeness.

Next, the system undergoes integration testing to evaluate functionality of the system between and among units by combining units together – beginning with two units and continuing until all units are combined – until the system is fully assembled. Again, like unit testing, outside evaluators (in this case programmers) test during integration by looking at a variety of factors (e.g., communication among units, synchronization among units, and proper interface implementation).

Finally, the training system is evaluated during validation/acceptance testing by the client, stakeholders, and users (e.g., instructors, learners) to ensure the entire system is performing according to the goals of the system. This evaluation is guided by the client, stakeholders' and learners' expectations for the system as indicated during the analysis phase. During the testing phase, any problems found may require some additional coding or modification of code.

The Blended Model: A Holistic Approach to Creating and Evaluating Web-based Learning Environments

Each of the perspectives brings a unique point-of-view to the evaluation of Web-based training and other educational environments. Blending the three approaches helps to ensure a holistic assessment of content from both learner and organizational viewpoints, and of the learning environment from learner, instructor and organizational viewpoints. This blended approach considers professional standards from each subject matter expertise – educational, psychological and technological – during the evaluation of Web-based training.

The educational and technological perspectives prescribe a process for creating online learning that ideally includes evaluation throughout creation, while the psychological perspective focuses only on evaluation after implementation or delivery of the training. The educational and psychological perspectives include a substantial amount of evaluation to assess the effectiveness of the training, and to obtain suggestions for modifications prior to the next implementation of the Web-based training.

Uniquely, the educational perspective is the only one that ensures that training content is accurate; the psychological perspective is the only one that measures the long-term affects of the training on the learner and the organization; and the technological perspective is the only one that ensures accurate functionality of the training system. While the educational and psychological perspectives are concerned with the front-end or what the learners, instructors and others *see*, the technological perspective is concerned more with the back-end or *what supports the training* on the Web. The technological perspective only considers the front-end insofar as the interface adheres to user- and usage-centered interface design principles, which will help ensure the learner can focus on the content to be learned rather than becoming distracted by a poorly designed system. This does not mean that the learner will not have to learn to use the system, but ensures that the system supports the learning and does not artificially interfere with learning.

What makes the blended approach more holistic is that all elements of the training system that affect the learner's experience are considered in order to make improvements – the content, cognitive level of learning of the content and learning exercises, appropriateness of activities and assessments for the learner, and the suitability of the interface and system to support learning in accord with hardware and software constraints. We propose that this blended model not only combines perspectives but also refines them into five phases as shown in Figure 3, with evaluation interwoven throughout much of the process as explained in Table 1. The model also depicts the three perspectives (which helps depict their influence on the blended approach) and briefly describes the focus of each phase as defined by the blended approach.

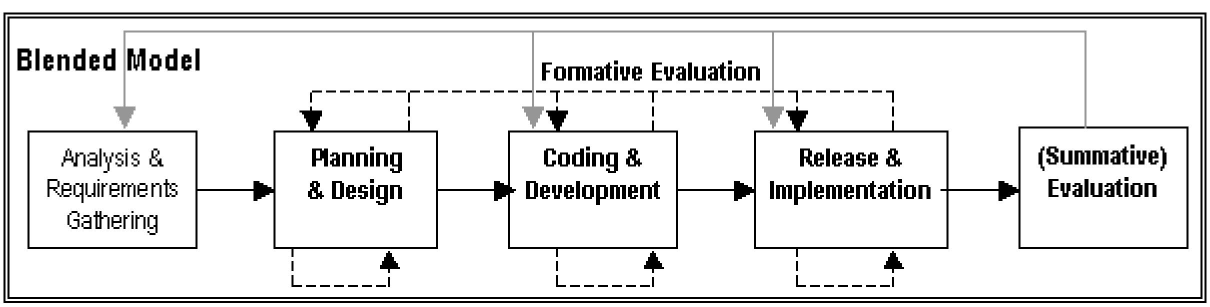

Figure 3. The Blended Model with a focus on evaluation.

Table 1. Phases of the Blended Model.

Blended Model	Analysis & Requirements Gathering	Formative Evaluation			Summative Evaluation	
		Planning & Design	Development	Release & Implementation	Near-Term	Far-Term
Description of the Blended Model's Phases	Define scope of the content for the training, pre-requisite knowledge of the learners; appropriate technology to support the training environment, existing systems that the training will interact with and the technology limitations of learners.	Determine the goals and objectives, instructional strategies, activities, student assessments and other material needed for training content. Devise a Web-based technology plan, including databases, interfaces, software and hardware. Obtain feedback on the plan and design.	Create the training content and the technology to support it iteratively. As "chunks" are developed, obtain feedback on the chunks.	Deliver the training, which is administered by the instructor(s) or completed as self-paced training by learners.	Determine if learning occurred as intended. Assess the reaction of the learners to the training content and environment. Obtain feedback on the content.	Assess the long-term impacts of the training such as change in performance on the job and improved corporate return-on-investment.
Educational Perspective (ADDIE)	Analysis	Design	Development & Formative Evaluation	Implementation	Evaluation	
Psychological Perspective (Kirkpatrick)				Evaluation: Reactions Evaluation: Learning	Evaluation: Performance	Evaluation: Performance Evaluation: Results
Technological Perspective (SDLC)	Software Requirements Analysis	Design	Code Generation / Testing	Release	Support	

The *Analysis and Requirements Gathering phase* begins with a thorough analysis of the performance-gap or knowledge-gap experienced by the organization. The purpose of this analysis is to ensure that training is the best solution to the organization's problem by identifying the challenges and examining potential solutions to problems from an organizational, stakeholder (e.g., supervisors) and learner viewpoint. Then, a determination of whether the Web-based learning is the best solution is explored by examining the number of learners who need the training, the technology available at the hosting facility and learner location, and the competency level of the learners. Once it is determined that Web-based training is the best solution, an overall goal for the training is established.

Also in this phase, the parameters of the training are defined, including the content to be covered, level of learning that is needed (e.g., from memorization of facts to gaining problem-solving capabilities in the content domain), specific target audience who will participate in the learning, technological capabilities of the hosting facility (e.g., the organization), and the number of learners to be trained. The attributes of the learners are also gathered including, prerequisite knowledge (what they already know that will affect the training content), technological capabilities of the system(s) they will use to participate in the training (e.g., at home, in the office), and proficiency with the use of the Web and Web-based training/learning environments.

In the *Planning and Design phase*, objectives (from the vantage-point of the learner) are written that support the learning. For example, a learning objective for a course that attempts to teach at the problem-solving level of cognition might read, "At the completion of the training, learners will be able to evaluate a proposal for thoroughness, completeness, accuracy and cost." The appropriate mode of the Web-based instruction – self-paced or instructor facilitated or a combination – is also determined. If appropriate, content is broken into "chunks" or lessons, which will in part dictate how development would proceed. Instructional strategies and learner activities that support the learning within that mode are then selected – these can be activities that the learner can complete on their own, with other learners online, with other learners in a face-to-face exchange and so on. Determinations are made regarding the inclusion of multi-media (e.g., sound files, videos) and tools (e.g., discussion boards).

Technology that supports the learning and is within the budgetary constraints of the organization and stakeholders is selected. These include databases to hold data submitted by learners, interface design, software and hardware needed. If the training is meant to use an existing learning management system or course management system, the system(s) is (are) examined to determine if modifications are needed to support learning.

Planning for the content and technology to be used based on the capabilities of the host system and the learners is critical prior to design. This plan and design establishes the constraints of the system, and therefore, the constraints on the learning content and activities that are created in the development phase. It is during this phase that formative evaluation begins. Outside evaluators (subject matter experts such as programmers, systems designers, interface designers, content experts) review the plan and design for adherence to the requirements gathered prior to the development of the system, and alignment with professional standards. In particular, the plan for training design is reviewed to ensure that learning activities: support the desired cognitive levels of learning (indicated in the learning objectives), can be accomplished with the technology desired for the activity and can be implemented given the constraints specified in the analysis and requirements gathering phase.

The *Coding and Development phase* begins the implementation of the plan and design created in the previous phase. Development of the content and activities begins simultaneous with the creation of the back-end (e.g., databases) and front-end (e.g., interface) of the learning environment.

Formative evaluation is also conducted, and occurs at multiple levels. For example, as the content and activities to support a lesson are created (and prior to their implementation on the Web) subject matters experts review them for clarity and alignment with the cognitive levels of learning for the training. Then, the lesson is built on the Web and evaluated again by experts knowledgeable in interface design, programming and systems design. As additional lessons are created and implemented on the Web, they are again evaluated by subject matter experts and experts knowledgeable in interface design, programming and systems design to ensure congruence of the navigation and usability of the interface. Prior to implementation, the completed training program is evaluated by the client and/or stakeholders, subject matter experts, systems designers and programmers to ensure that the training is cohesive – including the content, activities, navigation, interface(s), database(s) and other systems.

In the Release and Implementation phase, the training is actually delivered and implemented with the learners. Depending on the design, the instruction can be either led by instructors, or completed independently by learners. In addition, subject matters experts and experts knowledgeable in interface design, programming and systems design can "lurk" during the administration of the training, or observe the implementation of the training by reviewing virtual classroom sessions, online discussions, assignments submitted by learners, and other training artifacts.

In the *Summative Evaluation in the Near-Term phase*, the training experience is evaluated immediately after the training is completed. This means that assessments to measure student learning are administered in the learning environment, and learners evaluate their experiences in the learning environment. If training is conducted over an extended period of time, near-term evaluation can be conducted after each lesson so that problems and challenges can be addressed before completion of the training.

In this *Summative Evaluation in the Far-Term phase*, the long-term effects of the training are assessed. For example, change in learner performance as related to, and as a result of, participation in the training can be assessed through performance evaluations completed by supervisors or through individual job productivity. The affect on the organization can be measured by factors such as changes in morale, turnover, absenteeism, and safety violations as they relate to the training.

The blended model is a way of bringing together proven approaches from fields related to Web-based training design to influence the creation and evaluation of training so that the training supports learning and contains the capabilities needed by organizations. In conducting evaluation using this approach, an instrument should reflect the blending of the approaches such that all aspects of the training are considered.

The Blended Model of Evaluation

The blended model of evaluation combines the evaluation approaches from three traditionally unrelated fields into one holistic evaluation method for web-based training. Using this model, evaluation data can be collected from the training team, learners, supervisors and organizations. The training team consists of a training designer in charge of developing the training, other team members who are designing and developing content including, other training designers, systems designers, programmers, interface designers, graphics designers, and content-subject matter experts. Data can be collected from learners as they proceed through and complete training or during development from individuals similar to those who will eventually be the learners. Finally, some time after training was implemented, data can be collected from supervisors of the learners and from organizations to which the learners belong.

Tables 2 and 3 provide example evaluation questions blended from each of the three perspectives. In the far left hand column of this exhibit is an indicator of who data would be collected from in order to answer each question, while the columns suggest the type of information gathered by each person at each phase of the blended model. After each example measure is an indication of its primary influence – educational (EP), psychological (PP) or technological (TP). The perspectives can be combined and questions usually asked in one type of evaluation can be improved upon through the influence of another type of evaluation. Because evaluation refers to the assessment of an existing or planned training Web site (once analysis and requirements gathering has determined that training is the best solution to identified problems), evaluation in the blended model begins in the design phase.

In the blended model, evaluation occurs throughout the development process. Feedback should be obtained early in each phase and throughout the phase. For example, after a design for a portion of the training Web site is establish, it can be sent out to learners for review as the design for other areas of the Web site continues. In the design phase, the training designers select learner activities that are appropriate for the Web-based delivery medium, reflect the goals of the organization and allow learners to build the knowledge and skills they need to improve performance. In this phase of evaluation, information can be collected from the training team, learners and supervisors. The training team answers questions about the scope of the web-site designs, the match between the training goals and objectives, the appropriateness of the training goals, training content, and the completeness of the web-site design, while learners (or individuals similar to those who will eventually be learners) provide feedback on the sufficiency of information, the accessibility of documents, and the instructional activities. As additional portions of the training are developed, evaluation should continue.

During the development phase the training team, learners and supervisors assess the content and presentation methods, the relationship of the content to the training goals, the source code and web-site functioning Next, during the implementation and delivery phases, the training team, learners and supervisors answer questions about issues such as the continuity between the objectives and the outcomes of training, the appropriateness of the goals, the efficiency of the web-site.

At the conclusion of training, near-term and far-term evaluations are conducted. For near-term evaluations, the training team and learners answer questions about whether the training goals were achieved and if the training should be modified. Learners can provide information at this phase about how much they actually learned, and whether the learning activities facilitated their learning. In far-term evaluation, supervisors can provide information about the extent to which the training impacted job performance. In this phase data can also be collected from organizations to determine if the training had an impact on the organizational level issues such as morale, turnover, and accident rates.

By drawing on the educations, psychological and technological perspectives, the blended approach to evaluation can provide more informative and accurate information about a Web-based training program than any individual perspective. Combining these approaches can help to ensure that the quality of Web-based training in maximized.

Table 2. Example evaluation measures using a Blended Model approach. Focus on information the Training Team provides.

Who provides data?	Formative Evaluation			Summative Evaluation	
	Planning & Design	Development	Implementation & Delivery	Near-Term	Far-Term
Training Team	▪ Do the training goals and objectives reflect the desired outcomes of the training (as specified by the organization)? (EP) ▪ Are training goals at the appropriate level of learning (e.g., problem-solving)? (EP) ▪ Is the content accurate? (EP) ▪ Do the training content and activities reflect the real-world? (EP) ▪ Does the training (e.g., independent Web site, learning management system) work properly in multiple platforms that learners use (as indicated in the requirements gathering or analysis stage)? (TP) ▪ Is the training web site design complete, accurate and traceable back to the system requirements? (TP) ▪ Does the training web site design follow accepted software engineering design principles (loose coupling, high cohesion)? (TP)	▪ Do the training goals and objectives reflect the desired outcomes of the training (as specified by the organization)? (EP)(TP) ▪ Are training goals at the appropriate level of learning (e.g., problem-solving)? (EP) ▪ Is the content accurate? (EP)(TP) ▪ Do the training content and activities reflect the real-world? (EP) ▪ Does the source code retain a proper balance between efficiency and maintainability? (TP) ▪ Do the test cases properly exercise and validate the training web site? (TP)	▪ Do the training goals and objectives reflect the desired outcomes of the training (as specified by the organization)? (EP) ▪ Are training goals at the appropriate level of learning (e.g., problem-solving)? (EP) ▪ Is the content accurate? (EP) ▪ Do the training content and activities reflect the real-world? (EP) ▪ Does the training system pass all validation/ acceptance tests? (TP)	▪ What is the outcome of the training? Which training goals and objectives were achieved? (EP) ▪ Should the training be modified to help learners obtain the goals and objectives? Conversely, assuming the content is accurate, should the goals and objectives be modified to more closely align with the training content? If so, how should the training be modified? (EP)	

Table 3. Example evaluation measures using a Blended Model approach. Focus on information the Learners, Supervisors and/or Organization provide.

Who provides data?	Formative Evaluation: Planning & Design	Formative Evaluation: Development	Formative Evaluation: Implementation & Delivery	Summative Evaluation: Near-Term	Summative Evaluation: Far-Term
Learners		▪ Can the downloadable documents be accessed? (EP) Are they in the correct formats (e.g., PDF, Word)? (TP, EP) ▪ Is sufficient instruction provided for completing the online discussions? Virtual classroom sessions? Navigating the content? Other activities? (EP) ▪ Are the activities engaging and realistic for completing online? Is sufficient instruction provided for completing activities? Is the instruction accurate and easy to understand? (EP)	▪ Are the goals and objectives clear? Do they meet the needs of learners? (EP) ▪ Does the content make sense? Is it easy to read? (EP)	▪ Did learners learn the content? Did the activities facilitate their learning such that they can apply this new knowledge to their job? (EP, PP)	
Super-visors	▪ Do the training goals and objectives reflect the desired outcomes of the training (as specified by the organization)? (EP)	▪ Is the content accurate? Does it reflect the real-world? (EP)			▪ Did the training improve job performance as planned? (PP)
Organiza-tion	▪ Do the training goals and objectives reflect the desired outcomes of the training (as specified by the organization)? (EP)	▪ Is the content accurate? Does it reflect the real-world? (EP)			▪ Did the training change morale, absenteeism, accident rates and so on as expected? (PP)

Novice Designers and Real World Problems

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Abstract

The purpose of this study is to reveal novice designers' problems within which they are in the process of designing constructivist learning environments for formal school settings. Creating real world mathematics and science problems and embedding them into courses are a challenge for novice designers. Qualitative research method will be used to collect and analyze data for this study. Also, this study will propose recommendations on how to improve the training of novice educational program designers.

As one of the most recent developments in mathematics and science learning, embedded data design stands to offer reasoned decision making and motivation on students' transfer abilities. Also, problem complexity helps students deal with real world complexity and gain confidence in their beliefs in constructivist learning environments. Many researchers argue that when the curricula organized around authentic problems create more experiences that the students faced and learned informally in their daily life (e.g. The Cognition and Technology Group at Vanderbilt 1990; Brown, Collins, & Duguid, 1989). However, despite the continued emphasis on constructivism all over the world, it's still hard to find good examples of constructivist learning environments in Turkish Primary and Secondary School System on mathematics and science learning. Perhaps there is a lack of theoretical knowledge among designers or teachers and/or they may be having some problems during the development process.

Method

This study attempted to examine novice designers' problems when faced with the task of designing constructivist learning environments on mathematics and science for primary and secondary school curricula. At Osmangazi University in Eskişehir, Turkey, School of Education offers an elective course called New Approaches in Learning. Every fall and spring semester approximately 15 4th year (seniors) undergraduate mathematics and science students take this course as an elective. At the end of the course, each team (consisting of 3 or 5 students) has to develop a two or three hour program (for math and science courses) to facilitate learning for primary and secondary school students. Those programs are directed to support formal school courses and bring constructivist thinking for designing courses and motivating students. These senior students will be a formal school teacher next year in Turkish Educational System therefore, at least they have to have an idea about designing a constructivist learning environment.

The research project examines The Casper Project which was developed by The Cognition & Technology Group at Vanderbild (1997). For the project, students take real world mathematics examples from The Casper Project to develop their own problems. After developing their projects, the students tried the program out to see if it matched the constructivist learning environments' characteristics.

Hoepfl states that (1997, http://scholar.lib.vt.edu/ejournals/JTE/v9n1/hoepfl.html) the ability of qualitative data to more fully describe a phenomenon is an important consideration not only from the researcher's perspective, but from the reader's perspective as well. "If you want people to understand better than they otherwise might, provide them information in the form in which they usually experience it" (Lincoln and Guba, 1985, p. 120). Qualitative research reports, typically rich with detail and insights into participants' experiences of the world, "may be epistemologically in harmony with the reader's experience" (Stake, 1978, p. 5) and thus more meaningful. According to those explanations of qualitative research, the researcher used this method to gather rich and detailed data for this study.

11 students in the course participated in the study. Interviews with the students, questionnaire and the online discussion group were being used to gather data for this study. Interviews with the students took place all sections of the course such as in the beginning, middle, and the end. In the beginning the instructor and the students discussed the real world problems and The Casper Project conversed about their usage for designing instructional program. After beginning the developing process the conversation continued between the instructor and students.

At the end of the course the in depth dialogues were analyzed using a content analysis technique. All of the conversation process with the students were collected and coded for analysis.

To collect quantitative data from the students, a questionnaire that consists of 20 questions was given to the students at the end of the course. The questionnaire contained likert types of questions about the constructivist learning guidelines, real world problems and their usability in formal school setting. The researcher, according to the feedback of the students, was developed this data form during the developing process.

The third data collection tool was analysis of an online discussion group. The online discussion group consisted of the students who were taken the course and willing to participate to the study. All conversations, chats, and e-mails among them were saved to a computer with the intention that they could be used for elaborative data for the research.

Analysis of the data began with identification of the themes emerging from the raw data. During this coding period the researcher was identified and named the conceptual categories into which the phenomena observed would be grouped. As the raw data were broken down into manageable chunks, the researcher was coded the data and translated it into the story line. The results of this research indicated an in depth analysis of the strengths and pitfalls that students encounter when modeling The Casper Project Problems in a prescribed setting to design constructivist learning environments for formal schools' courses.

Results and Discussion

In order to create a constructivist, in this study a realistic context that is appealing and meaningful to students, learning environment for the novice designers was a big challenge. The researcher and the novice designers chose Jonassen's characteristics of meaningful learning to create constructivist learning environments (Jonassen, 2002, http://www.coe.missouri.edu/~jonassen/courses/CLE/index.html). According to these characteristics, the results are listed below:

Active: In order for the learners' activity, novice designers were embedded some cases into the program. The cases were designed with the collaboration of mathematics and science practitioners and two full mathematics and science professors. The designers, practitioners and professors were worked together as a development team for the projects. The most discrepancies for the teams were developing the real life situations in the cases and embedded them into the programs.

Constructive: Learners integrate new ideas with prior knowledge in order to make sense or make meaning or reconcile a discrepancy, curiosity, or puzzlement. They construct their own meaning for the phenomena (Jonassen, 2002). Knowing what the students knew was very painful process for the designers. To overcome for this problem, the novice designers were to work with the target group students during the whole design process.

Collaborative: *C*ollaborative cases were helped the designers to built collaboration among the students.

Intentional: Learners were encouraged with highly motivated goals such as *after completing this program you will be able to solve mathematics and science problems easily, also could transfer your knowledge into your daily life* after the program. It was not easy for the designer to indicate this goal for these level students. Therefore, the designers had to produce more real examples for the learners.

Complex: Creating ill structured and a complex learning environment was too difficult for the team. For this reason, all the members of the team were studied in the traditional system. In this system, all refined and oversimplified knowledge were given to them in their all school life. Therefore, they had difficulty to build a complex, ill structured and anchored learning environment.

Contextual: A great deal of recent research has shown that learning tasks that are situated in some meaningful real world task or simulated in some case-based or problem based learning environment are not only better understood, but also are more consistently transferred to new situation (Jonassen, 2002). In the cases, real life contexts were developed by the teams with the help of the learners.

Conversational: The cases in the program were designed to make them collaborate with each other.

Reflective: Cases and examples were connected to another situation with which learners can articulate what they are doing, the decision they make, the strategies they use, and the answers that they found.

Designing real world problems seems to be too hard for novice designers. Creating a good designing team, and conversation in the all designing process with the novice designers could be helped them for better understanding to design and develop a constructivist learning environment.

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Design, Implementation and Evaluation of An Online Faculty Development Program

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Abstract

The Anadolu University has established a center to help its faculty develop their pedagogical skills. The Educational Communications and Technology (EIT) Center has planned an online faculty development program in 2001 but was able to launch it during the spring 2003. Although 36 faculties enrolled the program only 12 of them completed. During this one month long structured completely online program, the participants took three online courses each of which had four modules. Although the evaluations of the participants, the facilitators, and the administrators of the University were in general satisfactory, the EIT and the program development team members did not find it successful. However, this first online faculty development initiative has provided significant lessons to the members of the EIT Center and the development team as well as to others. Among these lessons, blending the online activities with face-to-face interactions, creating an electronic performance support system that works as a part of an online learning community and motivation of the facilitators were noteworthy.

Introduction

Faculty development had been often viewed as a secondary priority before the advances in human resources development field. Practices in business have shown that organizations that invested on development of their human resources as well as other assets gained a better place and stayed longer in the market. So, most of the organizations have started to focus on development of their human resources since early 80s. As it has always been the case, the education field adapted this innovation quite sometime later than other fields. Despite this late adaptation, many higher education institutions have been investing on creating opportunities for the human resources, especially for their faculty, to develop themselves for some years.

Advances in information and communication technologies have provided universities to carry their faculty development programs from face-to-face to distance learning environments. Kelley (2002) indicated that because time is a precious commodity at higher education institutions and most of traditional faculty development initiatives require faculty to be bound to a specific time and space, the ability to have face-to-face training for faculty is virtually impossible. So, use information and communication technologies such as computers and Internet to create environments that could eliminate time and space barriers should be employed in faculty development programs. Today many universities such as Arizona State University provide online training to their faculty.

In Turkey, on the other hand, the idea of organized and programmed faculty development is quite new. After earning their PhD degrees (most of the times in the process of earning their degrees), the graduate assistants immediately start to teach. Usually they learn how to teach through either trial-and-error or observing elderly professors. This situation directly influences the quality of instruction in the universities. In order to solve this problem, one of the serious steps recently taken by the Higher Education Council (YOK – Yuksek Ogretim Kurulu), a government agent that organizes, monitors, and takes most of the decisions about higher education was requiring all the doctorate degree students -except the ones in the field of education- to take two standardized non-credit courses about instructional planning and assessment. The institutes of educational sciences in the universities have been assigned to offer those courses that aimed to help future faculty members gain the teaching skills. Although no study has been conducted to assess the effectiveness and efficiency of those courses, in informal conversations most of the students expressed their dissatisfaction with these courses.

Beside these mandatory courses for the future faculty, there are just a few plans or attempts to support the current faculty in Turkish universities. One of those attempts was the faculty development program of the Anadolu University. During 1999-2000 academic year, Anadolu University started an training program for its faculty. For the first year it was planned to help 185 assistant professors improve their pedagogical skills. The assistant professors were divided into groups. Each contained 25 people. They were asked to take 9 courses about different aspects of teaching such as assessment, academic consulting, and classroom management, so forth. It was a two week program and all the participants were required to join the classes 8 hours in a day.

Observations on the program revealed that attendance requirement and condense design caused high drop out rate. Almost 50% of the intended faculty did not complete the program. The ones who were able to continue the program also expressed that the full-time attendance requirement and condense structure had lessened the effectiveness, efficiency and appeal of the program.

Therefore, the University decided to offer this program online in 2001-2002 academic year. In addition, it was offered to establish a new center for a better organization of such activities as faculty, stuff and/or student support programs. As a consequence, the Educational Communications and Technology Center (EIT – Egitim Iletisimi ve Teknolojisi Birimi) was lunched in 2001. Its first activity was to design, develop, implement and evaluate an online faculty development program for helping the Anadolu University faculty members improve their pedagogical skills.

For this activity, three types of online support have been planned: information desk, development program, and online learning community. The information desk can be considered as an online faculty development handbook that consists of online articles about different aspects of university teaching and links to the online resources. Development program involves a structured instruction program that requires all the faculty members -especially the assistant professors- participate several short-term online courses. And the online learning community is an online communication environment, open to all the faculty members, where they can come together and share their experiences, ideas, resources, so forth.

Due to several reasons such as lack of technological infrastructure and support from the faculty, the project could not started in 2001-2002 academic year as well as the beginning of 2002-2003. However, during the fall semester of 2002-2003, one type of support system, development program, has been designed, developed and implemented in the spring 2003.

Design Considerations

This part of the paper gives details about principles that are taken into consideration while designing the online faculty development program.

In the literature there are several works on principles for effective faculty development programs. For instance, Murray (1999) pointed out that an effective faculty development program must (1) have institutional support, (2) be formalized, structured, and goal oriented, (3) provide a connection between faculty development and reward (e.g. academic promotion, support) structure, (4) promote ownership of faculty, and (5) create a belief that good teaching is valued by administrators. Steinert (2000), similarly, listed eight principles that guide an effective program:

- Understand and work within institution’s context/culture
- Ensure that programs and activities are based on needs
- Promote, buy, and market effectively
- Offer diverse program and methods
- Incorporate adult learning principles and theoretical framework
- Remain relevant and practical
- Work to overcome common problems
- Evaluate and demonstrate effectiveness

Kelley (2002) indicated that although Steinert’s principles were for a comprehensive faculty development program they do not distinguish face-to-face and online faculty development, and can be used to establish an online training program for faculty. So, these principles provided a framework for designing the Anadolu University online faculty development program.

In Turkey, presidents of universities have big influences on administrations. The president of Anadolu University has always been in favor of using technology into not only administrative but also instructional processes. So he accepted and supported the program of creating an online faculty development program at the first presentation of the program proposal. This support help designers overcome many operational problems and make the decision-taking process easy. In addition, the program presented to the deans of colleges and the directors of the departments to gain their support. Although most of them liked the idea, some mentioned their concern about technological infrastructure of the University. The president assured those deans and directors about solving the technological problems.

The main goal of the program was established as to improve the quality of instruction and as to extend the use of technology in learning and teaching processes by using technology to provide opportunities the faculty to develop their knowledge and skills. It was intended to create a program structure that provides participants a flexible learning environment to attain this goal.

A program development team that consisted of the members of the Educational Communications and Technology Center (EIT) and several members of the College of Education who worked during design of the previous face-to-face faculty training formed. At the end of needs analysis, the team has chosen four topics to be included into the program: (1) Course design, (2) use of educational media, (3) assessment and evaluation, and (4) academic counseling. Later, the team decided to design and develop three online courses covering these topics. The courses were titled as AGP01 Designing Learning Environments, AGP02 Interactive Instructional Media, and AGP03 Evaluation and Counseling. In addition, for each course a team that was responsible of designing, developing and implementing the course was also established. Mainly a content expert, several graduate assistants and instructional designers formed each course team. The program development team members also worked with these teams.

Additionally the program development team provided some already set standard organizational and instructional guidelines to the course teams. These guidelines were created in the light of Murray's and Steinert's explanations mentioned above. These guidelines were:

- The number of participants in a course should be 10-20 to provide a better individual and social learning environment.
- The maximum length of the course must be 4 weeks. The best times of the year for such an initiative to provide a satisfactory number of participation are October-December in the fall and March-May in the spring. So, each course should finish in a month and in a semester each course should be repeated three times.
- The faculty should be encouraged to take one course at a time. So that they will not overwhelmed with the requirements of the program.
- Each course should be designed into modules –one for each week- and requires only half or one hour of study everyday. Participants should be able to log on the courses anytime they want in a day. In order to provide this flexibility the asynchronous interactions should be preferred rather than synchronous ones.
- Since the program targets adults and professors, the language used during the program –even in the announcements- should properly be used. So, it was decided to use term "activity" instead of "course", never use "student" rather prefer "participant", choose "facilitator" instead of "instructor".
- It was concerned that some of the faculty might feel uncomfortable for taking a course from a faculty that has a lower academic title or be a participant in a course with faculty that has lower and/or higher academic titles. So, names and titles of the facilitators should be kept hidden in announcements and the facilitators should not to use their real names but nicknames. Also, opportunity to have and use a nickname should be provided to participants. So, not only participants should not know names and titles of the facilitators but also the facilitators should learn whom they are interacting with.
- The facilitators should provide detailed and enough directions on what they are expecting from participants to do. If it is necessary in daily bases, these directions should be reminded to the participants.
- Each participant may not have an advance computer at home or at office. So, the large files of documents, video or graphic elements, programs should be sent to the participants either as hard copy or electronic file on a CD via mail.
- Courses should support different types of interactions such as participant-to-participant and participant-to-facilitator, participant-to-content.
- Social interactions should also be encouraged among the participants and also between facilitators and participants.
- No exam should be administered during or at the end of courses to assess the achievement. Participants' performance should be assessed with their participation to the activities and their products (e.g. syllabi, PowerPoint presentations, reaction papers, etc.). Besides, a standard satisfaction questionnaire should be used by the program development team to get feedback from participants.
- Immediate feedback should also be provided to participants.
- For technological and administrative problems, participants should be directed to contact with the program coordinator who is actually a member of the development team member.

At the beginning, some members of the Center and some administrators of the University were in favor of requiring a mandatory participation due to concern that not enough number of faculty might want to join the program. However, volunteer participation was accepted because willingness seemed more proper to the nature of faculty development.

On the other hand, in order to encourage the participation, it was decided to give a participation certificate to every faculty who complete most of the requirements of the courses. The facilitators were required to decide the participants who should get the certificate. The certificates can be used for academic promotions.

Implementation

This part of the paper supplies information on the design, development and implementation processes of the online faculty development program. This part also provides an insight about what kinds of problems the program development team members had to deal with during these processes.

Ones the standards were set, the course design teams started to work. The biggest challenge faced was to convince the facilitators that no face-to-face meeting was necessary in this kind of a program. Most of the facilitators had no prior online learning and teaching experience. Even one of them indicated that he had no computer skills at all. So, they were a little bit insisted that at least at the beginning or end some sorts of in-class activities should be conducted. The program development team persisted that the program should be completely online and spent quite a time on training the facilitators on online education. Members of the team attended most of the course design team meetings and worked with the facilitators and other members of the course design teams.

Another problem encountered by the program development team was about ownership of the courses. Although the course design teams were often asked help from the program development team, they were, especially at the beginning, hesitant about interventions of the development team members. They wanted to own the course. So, they were assured that they are the owner of the courses and the development team members were there nothing else but to help them. The members were also advised not to intervene too much what the facilitators want to do during the course.

Some technological problems were also experienced during the development of the courses. The WebCT was chosen to present the materials and to manage online interactions because Anadolu University had already bought the license of this platform. The designers had few experience about this platform and also web authoring; and, they could not get any technological support and had to learn and develop most of the materials.

The design and development of the course materials took almost two months in the fall 2002. Since the spring semester in the University starts at the beginning of March 2003 and a time needed to the announcements, it was planned to launch the program in April 2003.

A web site was developed and published on the University web site. It was assumed that especially at the beginning of semesters faculty check the University web site often then other times, and while checking they can easily see and access the faculty development program site. So, they can find out the announcements. This assumption turned out wrong because just a few faculties visited the program web site and only two of them applied to enroll the courses.

After this unsuccessful attempt a new strategy was agreed to market the program and a new time schedule was created. Therefore, an email message consisted of announcement and information on the program sent to every faculty in the University. As a result of emailing, around 40 faculties applied to enroll the courses that were re-scheduled to kick of on May 2003. In was interesting that there were also 5 applications from other universities and 3 from private institutions beside the Anadolu University faculties. The program development team informed the outside the University applicants that this program was sort of an in-service training activity but in the near future we would like to open it to the outside applicants, too. Then, the team evaluated the applications and registered 12 faculties in each course. The other applications could not been included the program because they were new graduate assistants. Also, it was thought that it could be better to keep the number of participants as possible as few since this will be the first online teaching experience of the facilitators.

The participants were informed via email on how to register the courses and create nicknames in WebCT environment. A help line was also supplied to assist them via phone during the registration as well as during the whole program.

Only 17 faculties signed up at the end of registration deadline. The program development team phoned the ones who did not enroll whether they had a problem or not. Most of them asked for some more time to register while other indicated they were not able to attend due to several reasons not related to the program but to several other reasons such as heavy work load. Although some extra time was allowed to the ones needed only one of them signed up in the second week of the program implementation. This late participation was also accepted. So the program started with 18 participants.

However, along the way some of the participants dropped out and only 12 of them completed the courses. The ones who dropped out the program asked to indicate the drop-out reasons via email and phone couple times by both the facilitators and the program development team members. No respond received.

The participants had chance to use a nickname instead of their names. However only one of them chose to hide his name, others used their own names.

Although the facilitators were advised to include social and task-oriented group activities into their courses, the courses consisted of quite traditional methods. During the courses participants were asked to read the materials, do the practices, and answer the questions individually. In general, the course materials were basically static web pages and email tool. One of the instructors found sending hard copies of the reading materials easier than scanning and publishing on WebCT. Another one developed a multimedia program and saved on CDs. She also put the readings on these CDs and sent the participants via regular mail. The participants who were at the same campus had not problem in terms of receiving the mailed materials but there were couple participants from other towns who got the materials a week after the courses kicked off. Email was the mail communication tool in the courses. However, one of the facilitators tried to conduct a chat session. Only one participant joined this session.

After the courses completed, the participants were invited to meet with the facilitators and the program development team members. Only 7 of them were able to come the meeting during which the president presented the certificates to the participants. Moreover, they were asked to indicate freely their thoughts and recommendations about the program.

Evaluation

Evaluation of the participant faculties, the facilitators, the Anadolu University administrators, and the EIT Center and the program development team members have been summarized in this part of the paper.

A satisfaction questionnaire was developed to administer at the end of the implementation. It included items concerning media, method, and content employed into the courses as well as the facilitators. Additionally there were items related to general satisfaction for learning online. However, this questionnaire was not administered owing to insufficient number of participants.

On the other hand, as it has been mentioned above, the participants asked to express their ideas and recommendations during presentation of the certifications. Additionally, unstructured informal face-to-face interviews were conducted with some of the participants.

Almost all the participant concern and recommendation focused on heavy content of the courses, lack of enough directions and interactions. They indicated that it would be more beneficial if the content of the courses were lighter, goal-oriented, and require lesser work. They mentioned that sometimes they could not understand what they were supposed to do during the courses.

In addition, the participants indicated that the program and the training procedures were not introduced enough and as detailed as it should be. They said that this was one of the main reasons most of their colleagues could not attend although they though of.

The participants, however, found the idea of online faculty development very appealing and indicated that they would like to join voluntarily these sorts of activities in the future.

Besides the participants, the facilitators were also interviewed to learn their satisfaction from the courses. One of the main points that they mentioned was they did reach what they were planned to aim. Their main goal was to have an online teaching experience. They though that they learnt a lot during the program. They expressed that online teaching was not as easy as it seemed and required more work than in-class teaching. They pointed out the importance of motivation. They had no financial or any other type of motivation. They said that it would be hard to continue the program without any motivation.

Furthermore, the facilitators agreed on the necessity of integrating a face-to-face component to each course. They mainly used the participants' complains about lack of enough directions and interactions.

Administration of the Anadolu University, on the other hand, was pleased to be able to complete such a program and encouraged the members of the EIT and the faculty development program team to continue working on this program.

From the EIT and the program development team perspective, effectiveness of the program was evaluated in the boundaries of the framework provided by Steinert. Steinert's first guiding principle was to understand and work within institution's context/culture. Several issues, related to the Anadolu University' culture, were not noticed by the program development team and have influenced the effectiveness of the program. One of these was associated with the attitudes of the facilitators. Majority of the facilitators have had the idea that face-to-face interactions must be secured in this sort of a program in order to provide effectiveness, efficiency and appealing. They did not believe that faculty development can be achieved with a completely online program. However, they were asked to design their courses completely online. The EIT members thought that this attitude and obligation have influenced their performance in the program. In addition, although they have other duties and heavy work load, they volunteer to contribute this program because they wanted to have an online teaching experience. But during the design and development of the courses they noticed that online teaching required more time and work than face-to-face teaching. One of the facilitators even mentioned that if he knew online teaching was this hard he would not become a facilitator. The heavy work load of the facilitators and the program development team members have also lessen the effectiveness of the program.

Moreover, it was assumed that if the system built, the faculty will come. However, they did not. The program development team members and the facilitators tried hard to reach the faculty to encourage them to attend the program. Most of the ones who enrolled course were later indicated that they wanted to have an idea what an online course was. After having gone over the syllabi they had what they wanted and decided not to continue the program. This sort of an attitude can also be related to the culture of the organization as well as insufficient needs analysis procedure.

The EIT and the program development team members have also believed that improper marketing strategy was affective on low participation rate. In other words, the goal and the process of the program could not been introduced to the faculty adequately.

In sum, the EIT and the program development team members have indicated that the program was actually not a successful one in terms of reaching its goals, especially promoting ownership of the faculty and creating a belief that good teaching was valued by administrators. However, they have mentioned that they learnt a lot from this first experience and developed new strategies and ideas to make the online faculty development program of Anadolu University more effective, efficient and appealing.

Conclusion

According to Murray's and Steinert's principles of effective faculty development program, the online faculty development program of the Anadolu University can be considered as unsuccessful. However, some lessons have drawn from this experience.

One of the main lessons is correlated to Kearsley's (2002, p. 44) words: "I am sure that over time, more students, teachers, administrators, institutions/organizations, subjects, and cultures will become amenable to online education. But, for the present, it is important to think critically about whether it makes sense to offer certain course or program in online form and not to assume that it will work everybody." In other words, this sort of a program should have some face-to-face components because both the faculties and the facilitators are not ready for a completely online training in Turkey. But the number of the face-to-face components should reduce every time the program repeats. So that the faculties have a chance to feel the online learning and teaching experience in sort of a situated learning environment and be able to offer completely online courses and programs that require no time and space limitation in higher education institutions.

Another lesson learnt from this program is that some sort of a "kanban", or just in time approach might be better strategy for online faculty development due to heavy work load of the faculties. Scales (1997) states that electronic performance support systems can provide human resources of an organization/institution have the right training at the right time and place. Similarly the faculty might benefit from an electronic performance support system that aims to provide just-in-time training them. However, current research (e.g. Jones, 1995; Gunawardena, 1995; Nolla, 2001; Tu & McIsaac, 2002) have shown the significance of social interactions in learning environment. On the bases of these studies, it could be claimed that this sort of an electronic performance support system should be supported by creating an online learning community.

Building an online learning community might also help the designers of the online faculty development program create a more flexible environment in which each faculty can find something for her/his individual needs. Therefore, an ownership feeling can be promoted.

Another important lesson learnt is about motivation. Although the program provides some sort of a motivation to the participant faculty by the certificates that can be used in academic promotions, similar or different type of a motivation should be provided the faculties who help creation of this kind of a program. Especially facilitators need the motivation.

As a conclusion, this first online faculty support program in Turkey might seem not able to reach the goals but it provided valuable lessons to developers and coordinators of the program.

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Audio in Multimedia Learning: Principle and Practice

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Abstract

Research related to multi-channel communications provides very few guidelines to assist instructional designers in the implementation of audio in multimedia learning. In recent years, however, research studies conducted at the University of California have proposed several principles, some of which might be applicable to the implementation of audio in multimedia courseware and e-learning. This paper presents an analysis of current practices in commercial e-learning courses (N=18) that incorporate audio as a primary delivery media. The results indicate that the principles for temporal contiguity, coherence, and personalization are implemented for the majority of courses; principles related to modality and redundancy are not.

Introduction

Deciding when, where, and how to incorporate audio into multimedia programs is a very complex issue for instructional designers. Research related to theories that focus on multichannel communication and learning theories have been inconclusive (Barron, 2003). For example, Lang (1995) conducted an extensive review of the literature on multichannel research and examined 22 research studies. Her conclusion was, "Forty years of research has yielded a hodgepodge of contradictory conclusions" (p. 86). Moore, Burton, and Myers (2003) agree, stating, "We feel that instructional designers looking for simple rationale, methods, or guidelines for effective multimedia (multiple channel) presentation will be disappointed in the relevant research" (p. 998).

Compounding the dilemma is the fact that it is almost impossible to find more than a cursory reference to design guidelines for audio in textbooks that focus on the design and development of multimedia (see Lee & Owens, 2000; Horton, 2000; Kruse & Keil, 2000; Allen, 2003). Moreover, the few guidelines that exist are vague or contradictory. For example, Aarntzen (1991) stated, "When speech is used as the mainstream provider of information it should be accompanied by that same text on the computer's screen" (p. 363). However, other authors advised designers to "avoid echoing text with audio" (Gibbons & Fairweather, 1998, p. 375) and to describe graphics by "words presented in the form of audio narration, not by narration and redundant text" (Clark & Mayer, 2003, p. 109). Alessi and Trollip (2001) take a compromising approach, stating that the best approach may be to "provide controls that encourage learners to use either the text or audio presentation, not both at the same time" (p. 75).

Multimedia Principles

Recognizing the dearth of design guidelines, Richard E. Mayer and his colleagues have recently conducted dozens of research studies. These studies were designed to help answer questions, such as:

- How do people learn from words and pictures?
- What is the best way to design multimedia messages?

A systematic summary of the studies culminated in the book *Multimedia Learning* (Mayer, 2001), in which he states, "My premise in this book is that the answers to these questions require a program of careful, systematic research" (p. ix).

Several principles were derived from the research studies, many of which are applicable to the implementation of audio. The principles are a cognitive theory of multimedia learning, which "assumes that the human information processing system includes dual channels for visual/pictorial an auditory/verbal processing, that each channel has limited capacity for processing, and that active learning entails carrying out a coordinated set of cognitive processes during learning" (Mayer, 2001, p. 41). Specifically, the principles and recommendations listed in Table 1 were outlined in *Multimedia Learning* (Mayer, 2001) and *e-Learning and the Science of Instruction (*Clark & Mayer, 2003).

Table 1. *Principles and recommendations.*

Principle	Mayer, 2001	Clark & Mayer, 2003
Modality	Students learn better when words in a multimedia message are presented as spoken text rather than printed text.	Present words as speech rather than onscreen text.
Redundancy	Students learn better from animation and narration than from animation, narration, and text.	Avoid presenting words as narration and identical text in the presence of graphics.
Temporal Contiguity	Students learn better when corresponding words and pictures are presented simultaneously rather than successively.	Avoid separating information that must be integrated for learning.
Coherence	Students learn better when extraneous material is excluded rather than included. Student learning is hurt when interesting but irrelevant sounds and music are added to a multimedia presentation.	Avoid e-lessons with extraneous sounds.
Personalization	Multimedia messages result in better transfer performance (but not retention) when the verbal material is presented in a conversational style – using first and second person.	Script audio in a conversational style using first and second person.

Method

The purpose of this study is *not* to attempt to replicate or validate the research and principles set forth by Mayer. Rather, the intent is to examine commercially-available e-learning courses and determine whether or not the principles are being reflected in practice.

Eighteen e-learning companies were selected for the analyses, based on the following factors:

1. Prominent e-learning companies as determined by recent articles, publications, and industry analyses, -- e.g., *E-learning – Is this the bottom?* (Mirus Inc., 2002).
2. Companies that are marketing custom or off-the-shelf courseware at national and international conferences, such as Online Learning and TechLearn.
3. Companies marketing their online courseware through leading technology magazines, such as *Training* and *Learning & Training Innovations*.
4. Companies that provide an online demo or courseware that is available free-of-charge to the public.

After locating numerous online courses, the following criteria were applied to select the courseware included in the analyses:

1. Courseware that used audio as a primary delivery media -- courses without audio or with short, intermittent audio segments were excluded.
2. Courseware that included at least a major portion of an actual lesson (with functional interactions).
3. Courseware that was interactive and self-paced.
4. Courseware that was designed for adults.
5. If more than one course was available at a particular company, a topic of general interest was selected for review.

Table 2 lists the courses were selected for the analysis:

Table 2. Selected companies.

Company	Program/Lesson
Advance Online	Defensive Driving
Alamo Learning Systems	Rational Thinking
Allen Communication	Making History
Applied Learning Labs	Financial Literacy
Brightline Compliance	Preventing Workplace Harassment
Element K	PowerPoint 2000
GoTrain	DC Circuit Theory
IBM Mindspan	Marketing demo
Imparta	Marketing demo
Intercom Training	Good Grief, Good Grammar
KnowledgeNet	Cisco IP Phone
Lean	Lean Mfg Concepts and Principles
Medline Plus	Anthrax
NetG	Microsoft Outlook 2002
Prime Learning	Analyze Problems Creatively
Rosetta Stone	Spanish: Objects and Relationships
SkillSoft	Building Relationships for Continuing Success
Street Smart Communications	Ergonomics Training

Data Collection

A spreadsheet was created that contained all of the e-learning lessons and variables for investigation. Relevant parameters were defined, and drop-down menus were inserted with the variables. Working independently, both authors documented the information for each program. If there was disagreement between the responses, the issue was resolved by a third party (an expert in e-learning design).

The following information was collected:

1. Modality of the primary delivery media (narration/text)
    - Full Text/Full Audio
    - Full Text/Partial Audio
    - Partial Text/Full Audio
    - No Text/Full Audio
2. Redundancy related to animations
    - Animation/Text/Narration
    - Animation/Text
    - Animation/Narration
    - Animation – without Text or Narration
3. Temporal contiguity for animations/narrations (High, Low)
4. Presence or absence of sound effects and music
5. Coherence of audio and animations (High, Low)
6. Style of language (Formal, Informal)

Results

Modality Principle

The advice from Clark and Mayer is to "present words as speech rather than onscreen text" (2003, p. 86). To investigate the current practice related to this principle, each program was assigned one of the following values, based on the combination of instructional text and audio.

1. Full Text/Full Audio
2. Full Text/Partial Audio
3. Partial Text/Full Audio
4. No Text/Full Audio

The most common combination for delivery was Full Text/Full Audio -- text that was mirrored by verbatim audio. Ten of the courses (55%) employed this approach. The second most common format (33%) was Partial Text/Full Audio. This approach consists primarily of audio narration with bulleted text. Only one of the programs employed the No Text/Full Audio approach advocated by Clark and Mayer (see Figure 1). Another approach (Full Text/Partial Audio) was also used in one program.

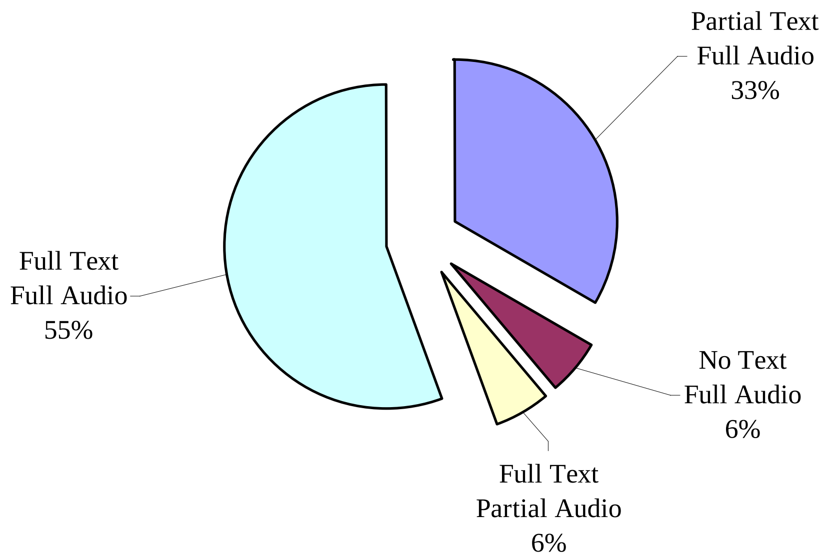

Figure 1. Implementation of audio.

Redundancy Principle

The redundancy principle states, "Students learn better from animation and narration than from animation, narration, and text" (Mayer, 2003, p. 147). Nine of the eighteen programs in this study did not contain animation sequences. The nine programs with animations were examined relative to the redundancy principle. The following options were noted for the animation sequences:

1. Animation/Narration/Text
2. Animation/Narration
3. Animation/Text
4. Animation – without Text or Narration

The most common combination for delivery was Animation/Narration/Text. This combination was observed in five of the nine programs (56%). The combination recommended by Mayer (Animation/Narration) was implemented in 2 of the programs (22%). In addition, one program consisted of Animations, without text or audio, and one program combined Animation/Text (see Figure 2).

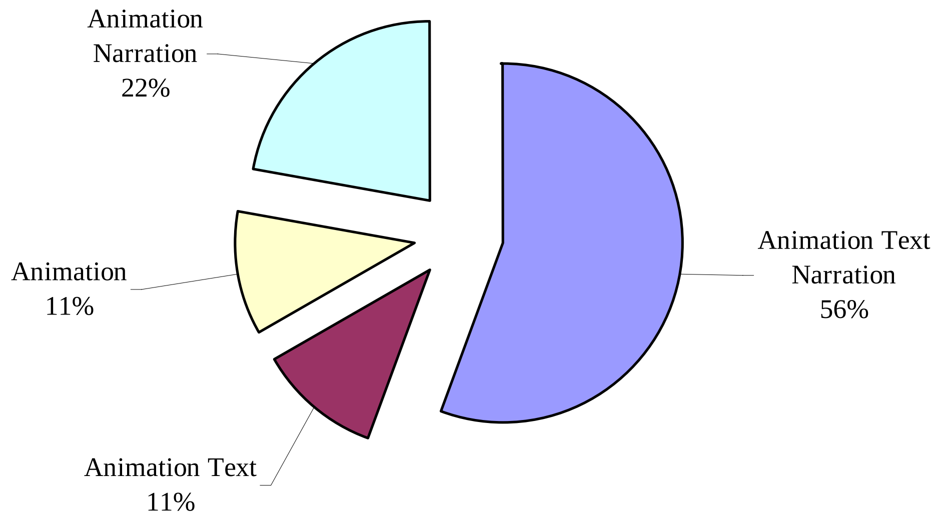

Figure 2. Implementation of animation.

Temporal Contiguity

Several of the Mayer's research studies found that learners performed better on retention and transfer tests "when corresponding portions of animation and narration were presented simultaneously rather than successively" (Mayer, 2003, p. 96). Looking again at the subset of lessons that contained animation sequences, the following values were assigned to temporal contiguity.

- High – most of the animations and narration were presented simultaneously
- Low – few or none of the animations and narrations were presented simultaneously

There was only one program that was judged to have low temporal contiguity (Advance Online). This program contained animations that played after the narration and introductory text.

Coherence

Mayer and his colleagues also found that, "Students learn better when extraneous material is excluded rather than included (2001, p. 113)." In the auditory realm, this would refer primarily to sound effects or music that are not necessary to convey the content.Table 3 provides information about the implementation and coherence of music and sound effects in the lessons.

Table 3. *Audio types and coherence levels.*

Company	Music (Y/N)	Sound Effect (Y/N)	Coherence (H/L)
Advance Online	N	Y	High
Alamo Learning Systems	Y	N	High
Allen Communication	Y	Y	Low
GoTrain	N	Y	High
IBM Mindspan	Y	N	High
Imparta	N	Y	High
Rosetta Stone	N	Y	High
Street Smart Communications	Y	N	High

Eight of the programs included music and/or sound effects. The coherence of the lesson was coded as High (those *without* extraneous audio material) or Low (those *with* extraneous audio material). Note that only one of the courses was judged to have low coherence – Allen Communications.

Personalization

Clark and Mayer recommend using conversational (informal) language rather than formal language. One aspect of informal style is to use first and second person rather than third person in the text and narration. Using this criterion, the audio in each lesson was evaluated to determine whether it was primarily formal or informal.

The results revealed that only two of the programs used Formal style (GoTrain and MedLine). In the other 16 programs, use of second person was prominent (see Figure 3).

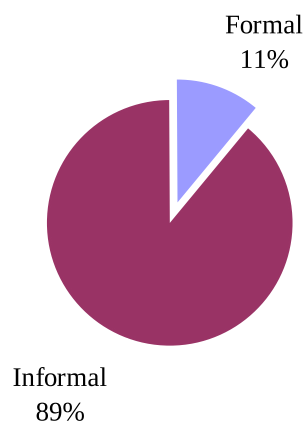

Figure 3. Style of language.

Limitations of this research

This research has several limitations. First, the selection of e-learning courses is a convenience sample of the lessons available free-of-charge on the Web. It does not represent a comprehensive view of the entire industry, nor does it provide a comprehensive view of the companies listed (only one program was analyzed for each company). The sample (18) is relatively small; the majority of the e-learning lessons that are available do not meet the criteria for inclusion (interactive lessons with audio as a primary delivery media).

In addition, no attempt was made to locate the designers or to query them as to their familiarity of the multimedia principles outlined by Mayer. Therefore it is impossible to analyze the rationale of the designers who produced the lessons. Whether their decisions were driven by theory, experience, bandwidth, or intuition cannot be determined.

Discussion

The purpose of this article is to provide a review of the principles related to the use of audio in multimedia programs. Programs developed by leading e-learning companies were reviewed, with regard to their implementation (or lack thereof) of the principles.

The majority of the programs (55%) incorporated a combination of Full Text/Full Audio. This is in contradiction to Mayer's Modality Principle, which advocates using spoken text instead of written text. There are a number of possible reasons that Full Text/Full Audio is the most common combination. First, and foremost, is the issue of compliance with Section 508 of the Rehabilitation Act of 1998. By providing redundant text and audio, the programs automatically comply with the requirement to script all narrations. Another factor may be the desire to provide flexibility related to learning styles and time requirements. Several studies have found that Full Audio delivery results in longer delivery time because of the inherent pacing of audio and the inability to skim through the material (Barron & Kysilka, 1993; Koroghlanian & Sullivan, 2000). With both audio and text options, students can decide if they want to listen to the audio or read the text. In fact, several of the programs provided options to turn the audio off completely (Advance Online, ElementK, IBM Mindspan, Intercom Training, Medline Plus, NetG, Prime Learning, and SkillSoft).

Only two of the programs examined (Imparta and Allen Communication) adhered to Mayer's Redundancy Principle, which recommends the combination of Animation and Narration. Most of the programs (56%) included both text and narrations with the animations. The predominance of an approach with both text and narrations is probably reflective of the number of programs that mirrored audio with verbatim text. Although it seems difficult to read the text, listen to the narration, and watch the animation concurrently, the text may have been included on the screen for ADA purposes. Another interesting point about the animations was the lack of learner control –most of the animation sequences played automatically, without options other than global screen options such as Next and Back. This is contradictory to recommendations by Alessi and Trollip (2001) that state, “Allow the learner to pause, continue, repeat, and in some cases control the speed of change” (p. 72).

In relation to Mayer’s Temporal Contiguity Principle, the programs fared quite well. Eight out of the nine programs with animations were rated as “High” for temporal contiguity, indicating that the animations and audio were synchronized and easy for students to follow. The availability of tools, such as Flash, with easy-to-implement, low bandwidth options for creating and delivering combinations of audio and animations enables designers to comply with this principle.

The Coherence Principle was also reflected in the programs that were reviewed. The programs included minimal music and sound effects. With the exception of one program, the few sound effects in the programs were short and pertinent to the content (such as the sound of a phone ringing). Although music was included in four of the programs, it was primarily used as background music in the introduction, and it did not distract from the content.

The argument for using formal language (third person) in a program is that it may convey a more serious approach to learning. However, Moreno and Mayer, (2000) conducted several research studies that compared a personalized version of a program to a formal version. “Overall, participants in the personalized group produced between 20 to 46 percent more solutions to transfer problems than the formal group” (Clark & Mayer, 2003, p. 137). The analysis of e-learning programs for this research revealed that 16 out of 18 programs used the informal style, consisting of first and second person.

Conclusion

Does the fact that current e-learning courseware do not necessarily adhere to Mayer’s modality and redundancy principles mean that these courses are less effective than they could be, or does it mean that these principles might not apply to interactive, e-learning courses because of differences in content, pacing, or learner abilities?

There are critics of the principles who note that most of the research studies, upon which the principles are based, consisted of extremely short (less than three minutes) segments (Tabbers, Martens, and van Merrienboer (2001). Although difficult to measure, most of the e-learning courses on the market appear to be designed in modules that range from 15 minutes to an hour in length. It is quite possible that the optimal modality and redundancy for retention and transfer differs, based on the length of the module and the length of the animations.

The research studies by Mayer and his colleagues primarily focused on technical, cause and effect explanations of how various devices or processes work – lightning, brakes, mechanical pumps, etc. Although some of the studies examined in this review had technical content, many of the lessons focused on “soft” skills, such as financial literacy, building relationships, and workplace harassment.

Another factor that may influence the applicability of the principles is the pacing/control aspects of the lesson. Mayer’s studies do not appear to include learner-controlled pacing (as is common in most interactive, e-learning lessons). Whereas Mayer’s modules were primarily composed of 90-180 second animation sequences, the e-learning lessons consisted of numerous, short segments (10-60 seconds) with learner control. This difference could easily vary the impact on the cognitive load required for various media. Tabbers, Martens, and van Merrienboer(2001) conducted studies and found that “In the two groups in which the students set the pace of the instruction, no modality effect is found at all. Not only do the students in the visual-user group perform almost equally well on the transfer test, on the retention test they even outperform the students in the audio-user group” (p. 1029). Tabbers (2002) recommends, “Only in situations in which time-on-task is a crucial variable and the instructions are system-paced based on the pace of the narration, should spoken text be first choice in multimedia instruction” (p. 79).

Learner characteristics may also influence the optimal modality and redundancy in e-learning lessons. Mayer (2001) cautions that design principles based on research “must be qualified with respect to different kinds of learners. Additional research is needed to pinpoint the role of individual differences in multimedia learning” (p. 189). For example, some of his studies showed strong multimedia effects for students with low prior knowledge and weak effects for high prior knowledge students (Mayer, 1997). Similarly, high spatial ability students were more likely to show a greater temporal contiguity effect than low spatial ability learners (Mayer, 2001). Shih and Alessi (1996) seem to agree with Mayer about the need for qualifications in media research. They stated, “Media is a tool or a learning environment; we educators or researchers must have a better understanding of it before we can wisely use and design it. Therefore, further and multiple dimensions of research on using audio (sound or voice) in education and multimedia are suggested" (p. 217).

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Appendix

Advance Online – Defensive Driving
http://www.advanceonline.com/freecoursedemo.htm

Alamo Learning Systems – Rational Thinking
http://www.alamols.com/eLearning/web_advantedge.htm

Allen Communications Making History
http://www.mentergy.com/products/courseware/new_demos/RC%20PLP%20Demo/

Applied Learning Labs Financial Literacy

http://www.appliedlearninglabs.com/volt/htmlbased/voltsite.html
Brightline Compliance Preventing Workplace Harassment
http://www.brightlinecompliance.com/
Element K - PowerPoint 2000
http://www.elementk.com/e-learning/htm/
GoTrain Corporation– DC Circuit Theory
http://www.gotrain.net/demo.htm
Imparta/iCoach – Marketing demo
http://www.i-coach.com/(lujlw245ac4ofmnx5ihtr02x)/defaultlogin.aspx
Intercom Training Good Grief, Good Grammar
http://www.intercomtraining.com/
KnowledgeNet – Cisco IP Phone
http://www.knowledgenet.com/courselibrary/demosandguidedtours/ciscoshow2.js
Lean Performance Management
http://www.leanedu.com/demomenu.cfm
IBM/Mindspan – Marketing demo
http://media.lotus.com/learningspace/student/index.htm
Medline Plus – Anthrax
http://www.nlm.nih.gov/medlineplus/tutorial.html
NetG – Microsoft Outlook 2002
http://www.netg.com/demosanddownloads/
Prime Learning – Analyze Problems Creatively
http://courseware,geolearning.com/index.cfm
Rosetta Stone – Introductory Objects and Relationships
http://www.rosettastone.com/
SkillSoft – Basic First Aid
http://www.smartforce.com/corp/marketing/demo/safety.htm
Street Smart Communications – Ergonomics Training
http://www.streetsmartcom.com/flash/main.html

Metacontrol: Controlling the Audiovisual Enterprise

Joseph Bocchiaro III

Introduction

Universities, corporations, and institutions of all types have been deploying increasingly complex audiovisual systems over the last twenty-five years. Audiovisual control systems have evolved throughout this period, as the necessity to tie together disparate types of equipment has increased. With the development of sophisticated equipment has come the need to cohesively manage these systems within the overall enterprise. This paper explores the recent developments in interconnectivity between audiovisual systems, computer network hardware and software, control system software, inventory and maintenance, usage tracking, budgeting, and the many other advantages of metacontrol. "Metacontrol" is an artificial intelligence (AI) term meaning the "control of control systems." This paper tracks the evolution of these control systems and the gradual convergence with Information Technologies (IT) that is necessary for metacontrol to exist.

The Evolution of Audiovisual Control Systems

Audiovisual control systems have always served as an accessory to pieces of audiovisual, audio, and video equipment. Some of the earliest types of systems controlled one type or model of equipment, such as the "show control" or "multimedia" slide projector / audiotape units. Early audiovisual systems were completely customized, brute-force assemblies of TTL (transistor to transistor logic) controllers, relays, hardwired switches and lamps, and multi-conductor cables. As audiovisual systems grew, it became evident that these labor-intensive configurations would have to evolve.

Stand-Alone Audiovisual Control Systems

In the mid-1980's, four manufacturers almost simultaneously developed alternatives to the control wiring morass that was then the state-of-the-art. YORK CONTROLS, AMX, CRESTRON, and FSR revolutionized the industry with digital signal lines, programmability, integrated packaging, and expandability. Three of these companies remain as market leaders to this day. Their systems gradually took into account the growing number of control interfaces to external equipment that was developing. This included the traditional dry contact closures, RS-232C, infrared, and various proprietary signal protocols such as SONY VISCA.

As it became easier to build these systems, as demand grew, and as the size and complexity expanded, it became evident that the control systems would have to develop further. It may seem a surprise to us today that there was tremendous opposition to this particular evolution, as this was the first time that both hardware and software were necessary to make an audiovisual system operable. There was distrust in microprocessor technology that could "crash." There were already enough points of failure in audiovisual systems at that time (especially the CRT projectors!) so there was an unwillingness to take additional risks. However, the promise of cleaner systems was there, and many audiovisual integration firms created a new job description at this point, the "control system programmer."

Proprietary Control System Networks

The next two, interdependent major developments involved the human interfaces to the control systems, and the development of more robust proprietary digital networks. Each manufacturer produced a proprietary digital protocol that could link their distributed components such as camera controllers, power switchers, volume controls, etc. Most importantly, these networks linked the touch panel interfaces that would become the de rigueur standard of the industry. The ability to create systems with multiple, customizable and changeable interfaces, distributed throughout a room or building, with simplified cabling, ushered in a new era of audiovisual sophistication.

Meanwhile, the personal computer industry was commoditizing personal computers, and the cost of networking these computers was plummeting. The audiovisual industry remained fixed on a closed-box, proprietary-processor/software model. Because the reliability of personal computer operating systems was not robust enough for audiovisual systems, this approach worked very well. However, it was destined to change as audiovisual systems continued to proliferate in a myriad of markets, and as trust in the "WinTel" (Windows/Intel) platform reliability increased. Using a personal computer and an "off-the-shelf" touchpanel was not a mainstream idea yet. Interestingly, control system manufacturers were concerned with controlling personal computers through their mice and keyboard interfaces, but not necessarily interested in being controlled by the computers themselves. One exception, however, was the IBM "Interactive Multimedia Classroom," (IMMC) collaboration, which married an OS/2- based personal computer with an FSR control system. The age of computerized multimedia had begun.

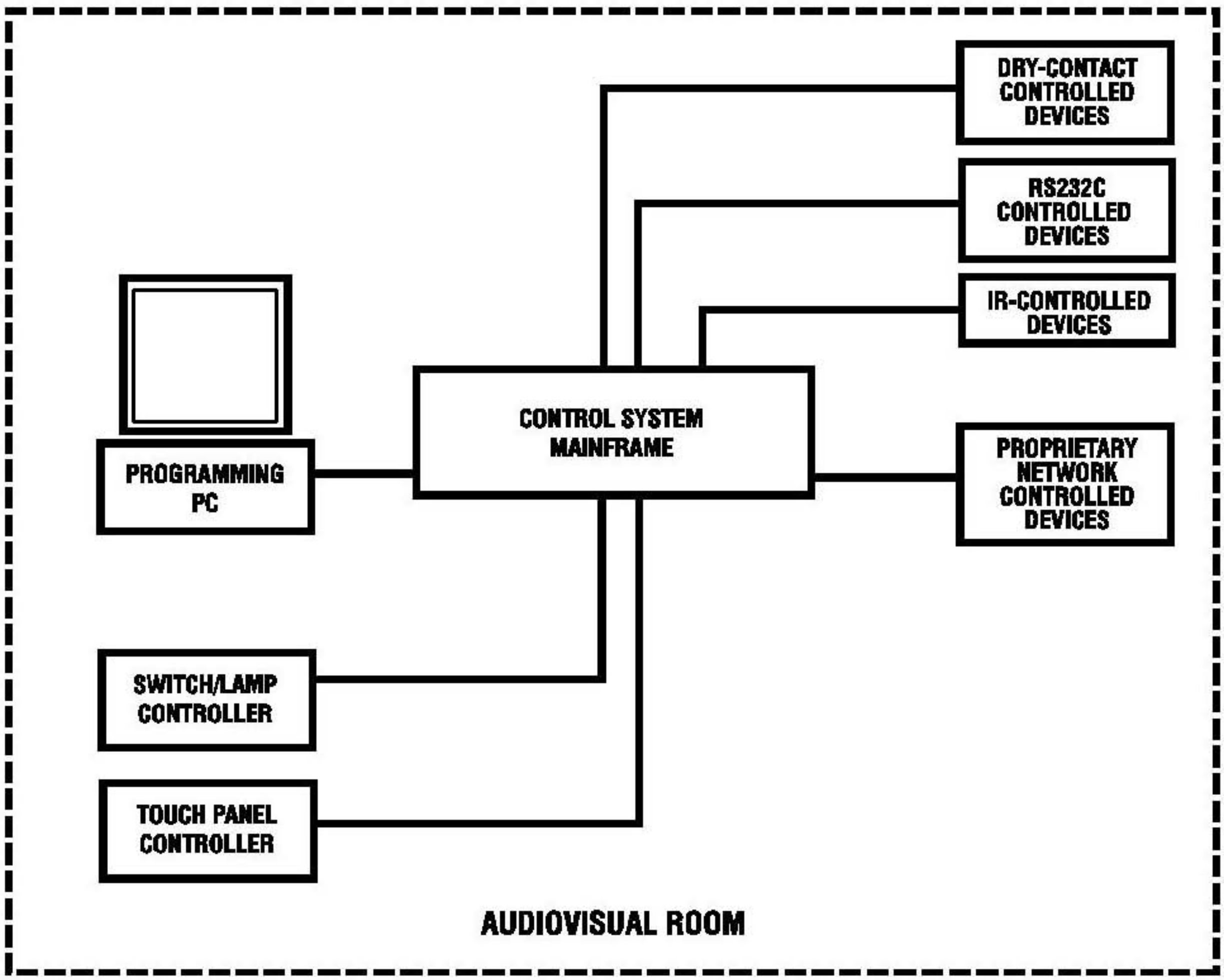

Figure 1. Proprietary audiovisual control system

LAN-Based IP-Enabled

The audiovisual industry response to consumer demands for more sophisticated home-based audiovisual systems has led to a wide variety of competing control solutions. The sheer market size of this industry has also brought the attention of the large software, network, and computer manufacturers. Industry consortia and proprietary efforts have led to products that are also useful to many other markets. This is particularly true in the areas of IP-based audiovisual distribution and distance learning. The forefront of AV/IT convergence lies in this area. According to Rashid Skaf of AMX, "It is essential to utilize the available telecommunications equipment. This is a market-driven requirement: multiple rooms that need to be connected to each other, share information with each other; utilizing the network infrastructure lowers the total cost of ownership."

The early efforts at programming for the Internet involved a programming language called JAVA, developed by SUN Microsystems. This flexible platform was ideal for the needs of the audiovisual control systems designers. However, the lack of computer industry cooperation with the JAVA language produced variations in the code, particularly with the Microsoft releases. This caused some unpredictable results in the implementation, and a different platform had to be developed. According to Fred Bargetzi of CRESTRON: "The first generation of Internet-enabled systems was designed for a 'cross-platform' operating system. Our second generation is based on ACTIVE X. This allows for numerous ways to interface to our systems: 1) conversion to HTML using ACTIVE X, which will work with a browser such as Internet Explorer (IE), 2) the conversion of web pages directly into executable files for speed and security, and 3) control from any industry standard device such as a Pocket PC PDA using 802.11b wireless, or from ‘web tablets’ such as the Viewsonics Viewpad.”

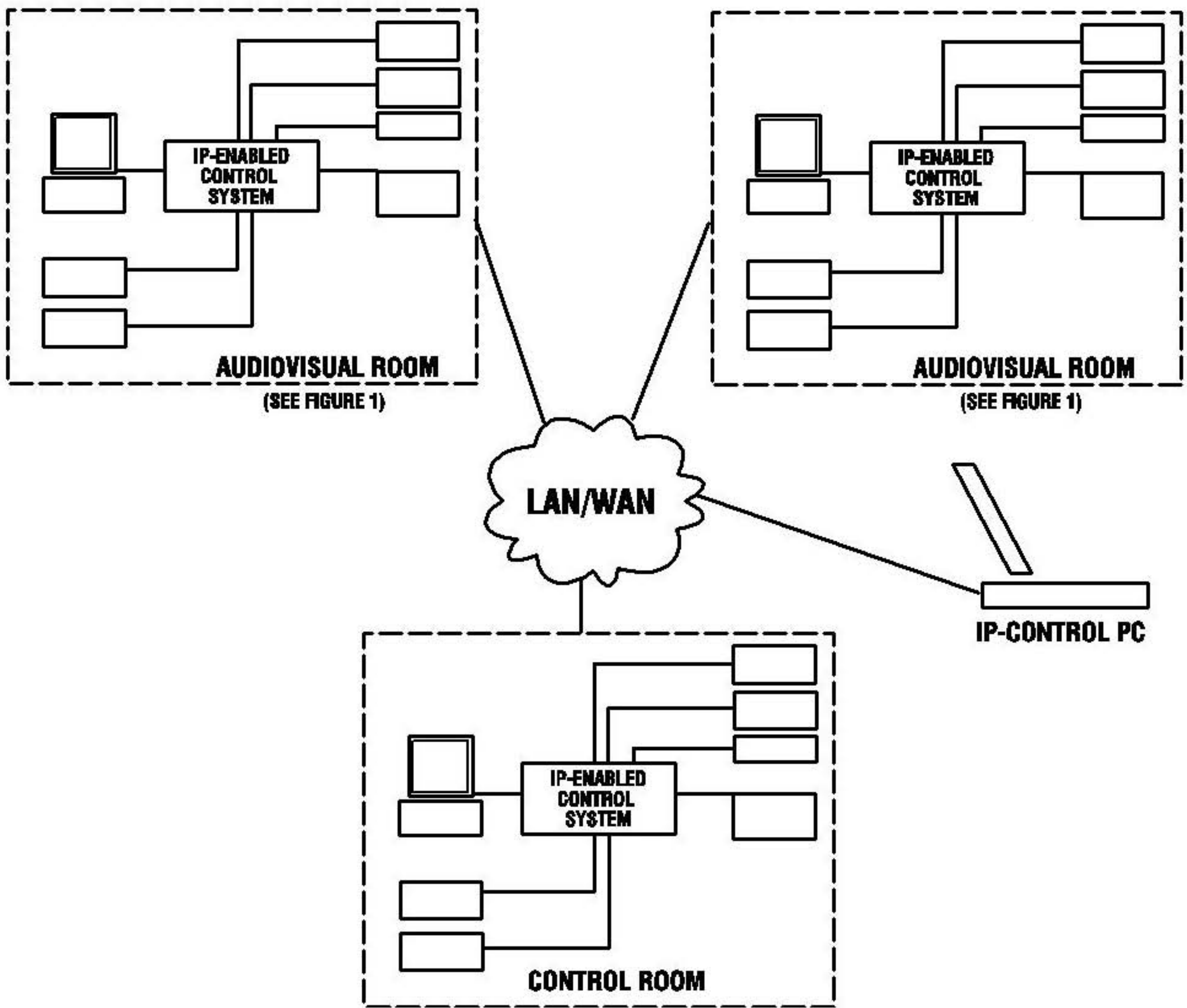

Figure 2. LAN-based/IP-enabled control system

While the audiovisual industry was transitioning to digital systems, the IT industry was already grappling with its own paradigm shift. This was the migration towards creating networks to connect servers with the proliferating personal computers. To make matters worse for the network technologists, there were already numerous operating systems, and network protocols varied between different manufacturers. This new equipment had to work with the legacy equipment, as well. In 1988, the Simple Network Management Protocol (SNMP) was developed, and rapidly became the de facto standard for internetwork management. Based on the “manager/agent” model, SNMP became the underlying code for the World Wide Web implementation of the Internet. According to Rick Egan of SIMTROL, “Browser-based connectivity to audiovisual systems is possible because of our ability to utilize data bases for managing system information; this is built with SNMP traps capturing and logging status changes.” Because each “agent” device requires minimal software, this protocol is referred to as “simple.” The “traps,” which are the event notifications from the “agent” to the “manager” are the fundamental means by which control and status are communicated through the network.

The use of a conveniently-accessed, familiar, ubiquitous interface such as Internet Explorer has opened up new possibilities for control systems. It has taken some of the mystique out of the systems, just as it has enabled more people to be able to access, program, and use them. However, as the ability to use lower-cost hardware components increases, the overall cost of the systems has decreased. As a result, users are now able to deploy more systems. This "tail-wagging-the-dog" effect has created an even greater need for connectivity between the systems, as audiovisual administrators find they are short-handed in their facilities.

Converged Audiovisual and Control Systems

While the audiovisual industry was developing its' Internet capabilities, the computer industry was at work on content delivery over the Internet. Referred to as "rich media content," this includes streaming audio, streaming video with audio, videoconferencing, data collaboration, etc. Finally it was possible to not only control media systems through computer networks, but to deliver the content simultaneously. Specialized components for the Internet market included sophisticated software CODECs (Coders / Decoders) to allow millions of ordinary computers to display video clips and live broadcasts over the Internet. The widespread deployment of broadband Internet connections encouraged users to take advantage of this technology. The use of familiar VCR-style control interfaces bridged the user interface between the hardware-based audiovisual paradigm and the software-based computer paradigm. Why not reverse this concept and use computer conventions for audiovisual hardware? And why not use computer hardware as well? This would indeed be the next step.

Meanwhile, the audiovisual industry was preoccupied by videoconferencing (VC) applications in all vertical markets. Sophisticated VC hardware allowed not just one but numerous users to connect and conference simultaneously (multipoint conferencing.) Connections through the traditional telephone interfaces evolved to IP connectivity, again pointing the way to a converged AV/IT environment. With this widespread use of VC came new problems, namely the control of multipoint control units (MCU's,) the scheduling of the rooms and the conferees, and the management and maintenance of the equipment. Low relative cost, disparate locations, and convenience encouraged tremendous investment in this technology, and created a new set of challenges for the audiovisual industry.

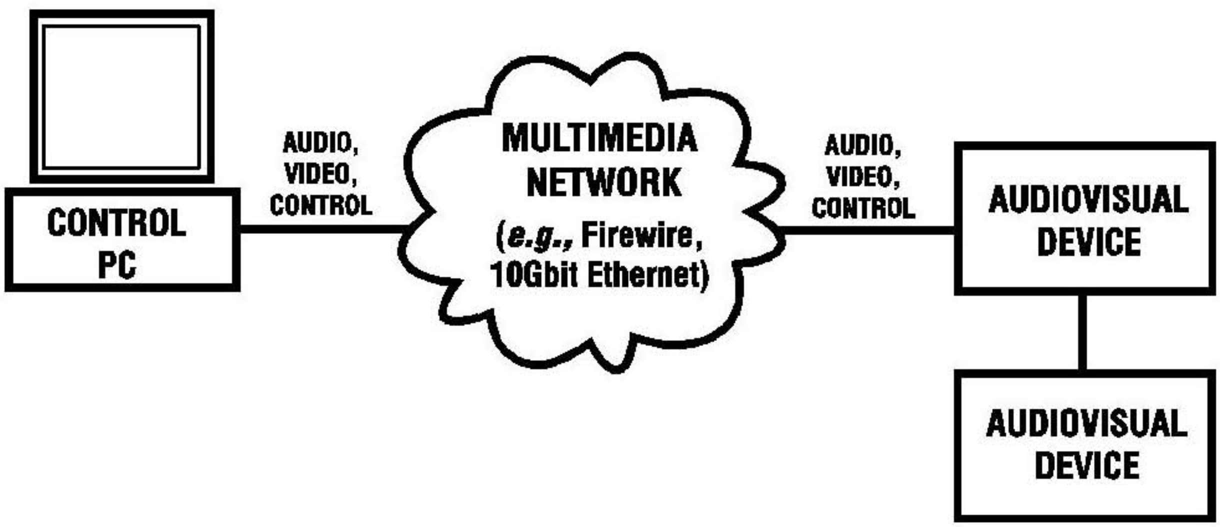

Figure 3. Converged audiovisual and control system

At last it was possible to foresee the end of one of the major stumbling blocks of the audiovisual industry: the plethora of cables, signal types, protocols, connections, and disparate equipment types. Perhaps the adoption of computer network technology could eliminate the labor-intensive aspects of audiovisual integration, while leveraging the tremendous volume discounts of computer hardware. Perhaps the single connection would soon be a reality, given the promises of virtually unlimited bandwidth over Gigaspeed or better cabling.

Embedded Audiovisual Control Systems

The potential size of the audiovisual control system market has not been lost on the rest of the commercial and consumer audiovisual manufacturers, or on the personal computer industry. Control systems are now appearing everywhere. As examples, the videoconferencing system manufacturers, (particularly Tandberg and Polycom,) offer powerful control software for their CODECs and MCUs (multipoint control units.) Polycom offers CODECs (the iPower series) that are actually personal computers that may be used as control system hubs. Tandberg has long recognized and allowed for computer connectivity, even providing a VGA interface to their units. Virtually all of the consumer audiovisual manufacturers offer integrated remote controls, some that operate many types of equipment, not necessarily of their own manufacture. Some even offer touchscreens that rival the comparable commercial units of a few years ago. Extron Electronics, the leading audiovisual interfacing, switching, and distribution manufacturer, has recently embedded a control system into their switching systems.

Not to be outdone, AMX, CRESTRON, and FSR now offer audiovisual components that incorporate their control systems. Virtually all audio and video components from other manufacturers are now at least digitally controlled if not completely digital, and require proprietary control systems to program and operate them. And as we will explore below, the computer software and hardware manufacturers are increasingly offering software-controlled connectivity to a variety of audiovisual components. Who is not familiar with the DVD and CD-player and recorder capabilities of virtually all current personal computers? Clearly the lines are now completely blurred between audio, video, computer, and control systems.

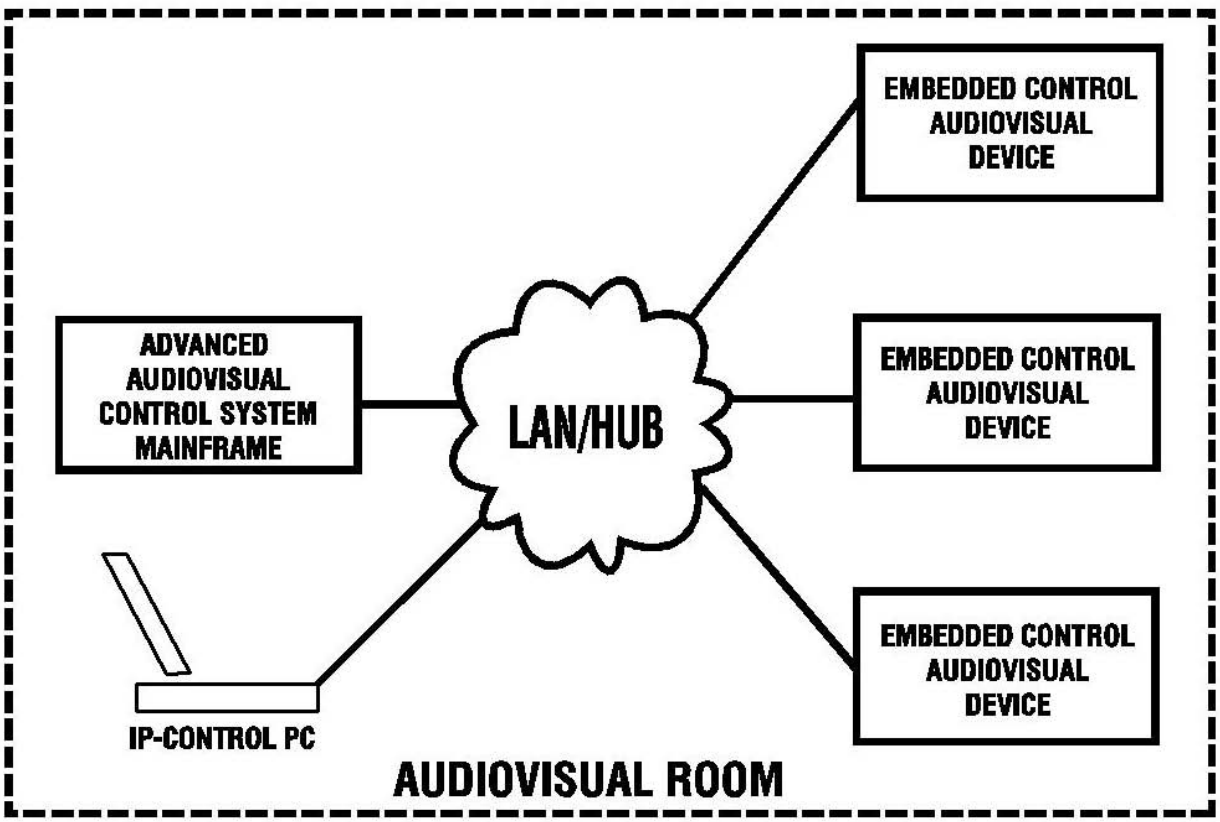

Figure 4. Embedded audiovisual control system

Distributed Component Control Systems

The proliferation of portable, digital media devices such as digital cameras, digital camcorders, MP3 audio players, PDA's (personal digital assistants,) and others, has created a "dymanic" network challenge. The computer industry has been working for several years to integrate data transport with a wide variety of control protocols. The two market leaders, Microsoft and Sun Microsystems, and an industry consortium called HAVi, have developed open-standards solutions to this challenge. With the development has come the recognition that networks are not necessarily static any more, meaning that devices may be connected and disconnected frequently, randomly, and without the aid or intervention of a network administrator. In addition, these devices may not be computer or network devices at all, but may be considered to be "network appliances," with embedded, dedicated-function network interfaces. Already a wide variety of such devices are available, such as those mentioned above, some cell phones, wireless networked personal computers, and now audiovisual control systems.

The promise of embedded network interfaces and control systems, with unique addresses and characteristics, is that devices may be connected, recognize each other, and communicate with each other. This becomes increasingly important as networks increase in size and in geography, such as over a WAN (Wide Area Network.) Rob Gingell of SUN Microsystems explains their JINI solution to this concept in the Sun publication "The Future of Software:" "…as you stretch the [network] space in one direction or another you discover that a lot of things aren't working well. The strategy of network transparency (a completely administered, and static network) fails with scale; what is effective when most of the parts work most of the time isn't a good strategy when the parts count is so large that something is broken all the time. All the transparency mechanism does is obscure the failure, since, after all, that was what it was designed to do; because, of course, the failure won't be around for long or occur very often. That's one of the motivators behind Jini Network technology… It doesn't assume the network's going to stay up, or that one size fits all answers and implementations for varying bandwidths, or that latencies are suitable. Jini technology makes you deal up-front with the network, and, in so doing, become a part of it rather than its adjunct…. JINI technology [allows] disassociated resources to discover and interact with each other, mostly in the form of devices out and about in the world….The technology acts as a vehicle for creating true mammals of the network- applications that exploit, rather than simply deal with, the properties of a networked environment."

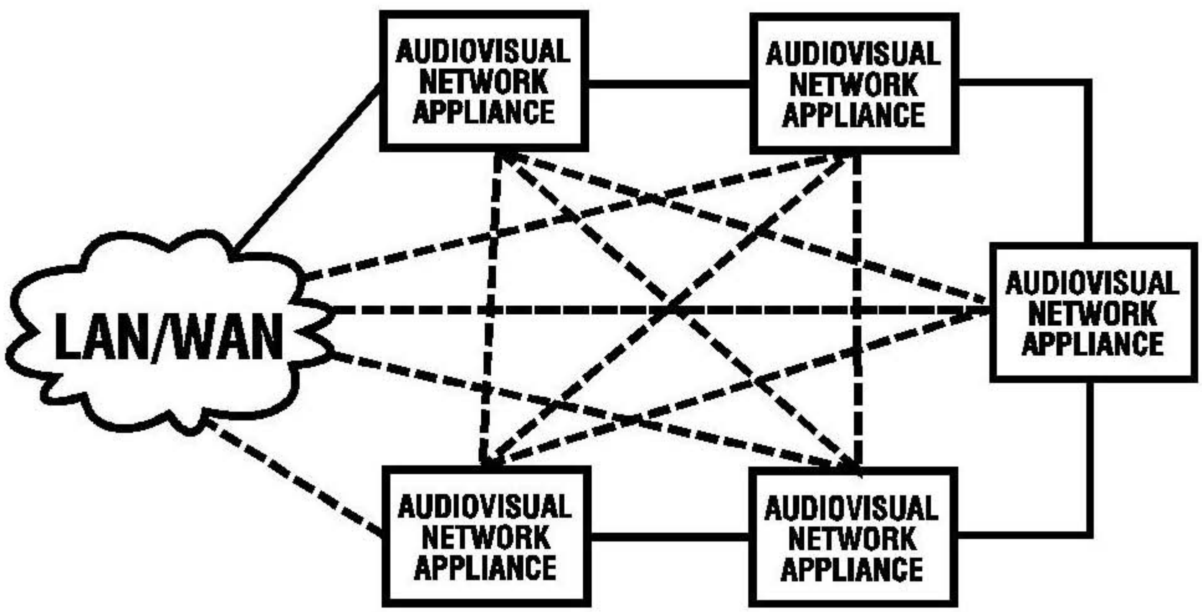

Figure 5. Distributed component audiovisual control system

In a competitive and similar fashion, Sibylle Haupert of Microsoft describes UPnP: "Universal Plug and Play is designed to bring easy-to-use, flexible, standards-based connectivity to ad-hoc or unmanaged networks in the home and small businesses. UPnP leverages Internet technologies to enable seamless proximity networking, plus control and data transfer among networked devices. Universal Plug and Play uses declarative wire protocols expressed in Extensible Markup Language (XML), and communicated via HyperText Transfer Protocol (HTTP). For Universal Plug and Play, networking based on Internet Protocols ensures a proven ability to span different physical media, to enable multiple-vendor interoperation, and to achieve synergy between the Internet and home and office intranets. Universal Plug and Play can also bridge to non-IP networks and protocols such as Simple Control Protocol (SCP)."

To put this into plainer English, the Microsoft White Paper, "Understanding Universal Plug and Play (UPnP,)" states "With UPnP, a device can dynamically join a network, obtain an IP address, convey its capabilities, and learn about the presence and capabilities of other devices - all automatically; truly enabling zero configuration networks. Devices can subsequently communicate with each other directly; thereby further enabling peer to peer networking."

The HAVi standard has been developed specifically for media-rich content and control of that content over various networks. The standard is supported by numerous consumer / commercial audiovisual component manufacturers. A primary transport hardware and software protocol called IEEE 1394, or, in Apple Computer's nomenclature, "Firewire," or, in SONY's nomenclature "i.Link," is used to combine all functionality over one cable. According to the HAVi Technical Background briefing, "HAVi provides an environment for audio and video devices to interoperate with each other, irrespective of the actual brands or their HAVi implementation. The HAVi architecture is open, scaleable in implementation complexity, platform-independent, and language neutral, ie., HAVi can be implemented in any programming language and on any CPU or real-time operation system… The benefit of a network of interoperable devices is that the whole is greater than the sum of all the components."

The HAVi standard, conceived initially for consumer / residential audiovisual applications, is complementary to the JINI and UPnP standards, as well as to Bluetooth, a wireless communications protocol. The recognition that the larger computer network industry is already creating a platform for larger-scale implementation allows HAVi adopters to concentrate on the smaller, although still complex, control issues. The devices that HAVi will control are not limited to audiovisual components, either. Other common household devices such as garage doors, thermostats, lighting systems, window shades, etc. are part of the network.

Basing the HAVi standard on a well-defined and widely accepted platform is an intelligent decision, and is indeed complementary to the Ethernet network architecture. The bandwidth of Firewire, recently expanded in the 1394b version to 800 Mbits/sec, is designed to eventually increase to 3.2 Gbits/sec. This provides connectivity that is just ahead of widespread Ethernet deployment of 10 Gbits/ sec, with eventual 40 Gbits/sec. Finally there is sufficient bandwidth for true audiovisual signals, which may require the transfer of real-time computer screens of 1280 X 1024 with a transfer rate of 414 megabytes/sec at a typical 72 Hz refresh rate.

None of these developments by leading manufacturers are ignored by the audiovisual industry. In fact, the smart companies are exploiting them. Says Bargetzi: "We're embracing the PC industry: anything that is a commodity item- we're making provisions for these to be used with our systems and software… This concept (distributed computing) is trying to bridge the world together: thin clients can communicate with others in a network." It is difficult to imagine any application with greater demands on a computer network than audiovisual, and the audiovisual industry stands to benefit from these advancements, whose development is largely funded by others. What that network consists of is open to question as well, as the bandwidth capabilities of Ethernet are developed to meet and exceed Firewire. The convergence on a solution is not to be developed by the audiovisual industry, according to Ken Kalinoski of FORGENT: "In the past we talked about the network- our clients have told us 'you have to work within the network I've got.' This is a client-driven marketplace."

Metacontrol and the New Capabilities

Metacontrol, a term adopted from the artificial intelligence field, is used to describe a condition wherein the complexities of interacting systems and changing events require an overall control mechanism. The recent advances in computerized audiovisual control systems, and the new, specialized audiovisual and control networks described above now allow for such overall control. Furthermore, the convergence of the audiovisual and information technology industries has opened up new possibilities for unifying many of the media production, distribution, and storage requirements of every corporate, educational, and other institution. As the information explosion continues, it becomes more and more important to manage this information, and the means by which it is presented.

Many of the audiovisual applications important to audiovisual personnel, facilities managers, and IT managers are affected and may be enhanced by this new technology. This is important both to institutions with limited resources and to those with a large amount of resources. Small institutions may rely on metacontrol to manage their shared rooms, bandwidth, and equipment. Larger institutions may use metacontrol for managing their considerable inventory with limited staff, perhaps across numerous cities or countries. Institutions with large amounts of data compiled in meetings, such as from voting, audience response, or collaboration, may use metacontrol to manage this information and organize it for the use of the participants in real-time or in an archive. In short, metacontrol holds benefits to any institution, especially those that are growing on a limited budget.

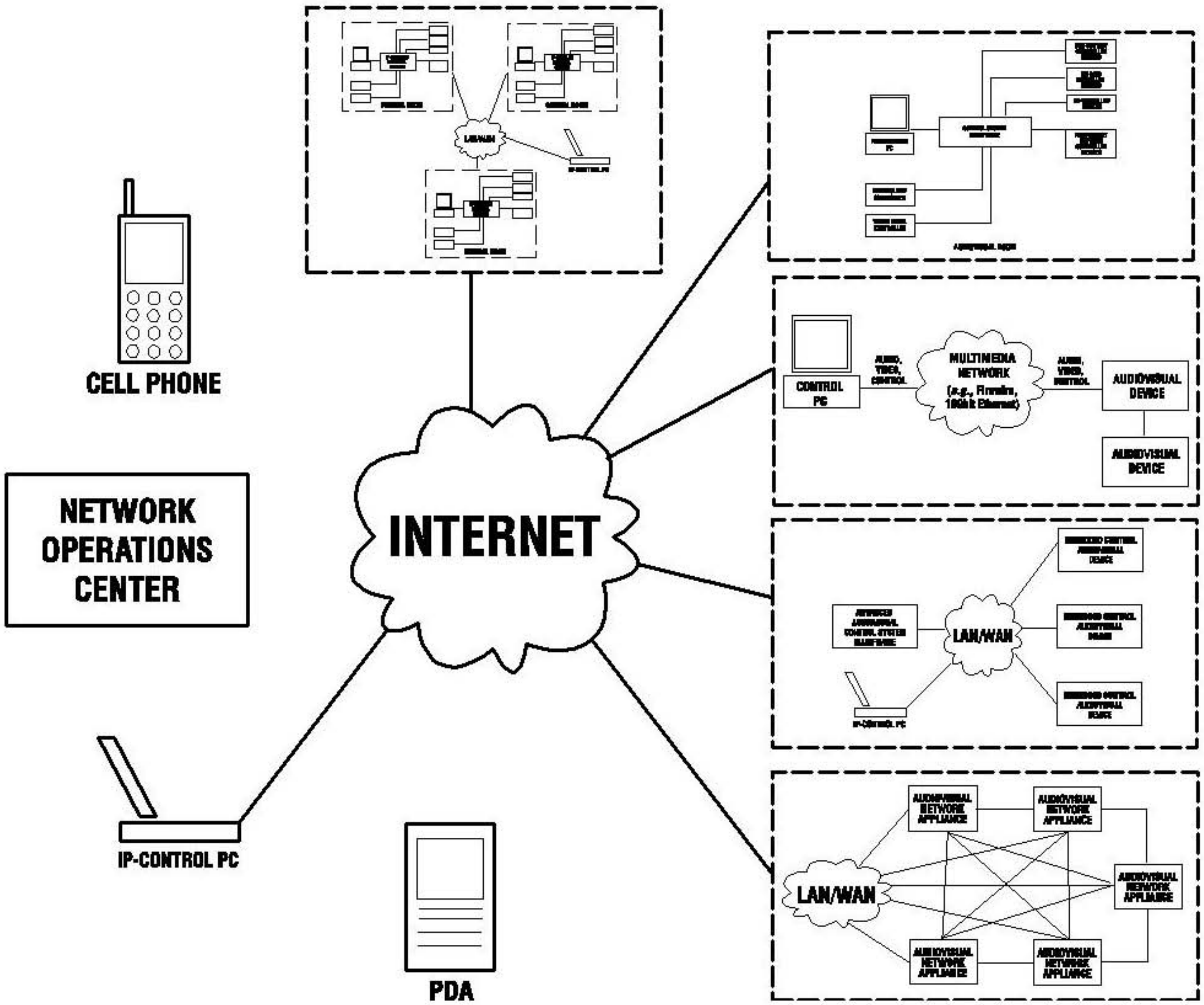

Figure 6. Metacontrol system

The concept of metacontrol is simply the "control of control systems." Of course it involves the use of computer-industry standards and protocols, rather than creating new ones. As such, at its core, metacontrol is an IT application. According to Kalinoski: "You have to bring everything back to work with IT, instead of trying to circumvent IT." This concept has grown in response to several industry trends. The first trend was the necessity to provide audiovisual professionals with the ability to monitor or alter the status of room-based audiovisual control systems, in institutions with many rooms. The next trend was the necessity to manage the audiovisual equipment inventories in these institutions. This includes routine maintenance issues, such as lamp changes in projection equipment, or the cleaning and lubrication of motorized equipment. As audiovisual equipment manufacturers began to incorporate more sophisticated control interfaces in their equipment, it became possible to monitor and control many additional features and equipment interactions. A logical extension of this has been to schedule rooms, students, instructors, and other resources.

The real benefits of metacontrol are realized in specific large-scale system features, which lie beyond the technical abilities of most users. According to Kalinoski, "Users do not care about all the network issues. Everything has to be handled at the user interface: endpoints, gatekeepers, gateways, routers, and switchers." First, the management of sophisticated equipment such as multipoint control units (MCU's) in corporate, institutional, or distance learning applications requires equipment connection, scheduling, bandwidth management, room scheduling, and session control. Another application is the scheduling of portable equipment in a multi-room environment. Still another is the help-desk functionality of multi-room environments with limited staff. Another is the automation of classroom events such as with media retrieval. Most importantly is the invisible, interconnected manner in which metacontrol configures audiovisual networks and makes them available for simplified and immediate use. This is of particular importance to wireless network implementations.

Much of the current emphasis in metacontrol development pertains to the audiovisual systems themselves. Rick Egan, of SIMTROL, explains, “Much of our development is focused on creating interfaces and functions that IT professionals already are accustomed to. This includes proactive system monitoring, system health and status, meantime between failures tracking, component shelf life, and alarms. IT professionals have a firm understanding of everything on their network, but when they go into the boardroom they don’t know what’s going on.” Migration to metacontrol systems will enable the IT professionals to better integrate audiovisual systems into their universe. Egan continues, “The whole control system is network-based, from the boardroom to the NOC (network operation center.” It can be seen then that if metacontrol is to be utilized in the future, or planned from the beginning, then audiovisual systems should be designed from the beginning to allow for it.

Metacontrol goes beyond just the ability for remotely-located administrators to manage audiovisual systems, however. According to Skaf, “I see the real evolution in the industry is that we’re currently in control, but the ultimate goal is true automation: based on rules, not people touching buttons.” The possibilities for this technology are boundless. Skaf continues, “Proctor & Gamble have been conducting consumer research into the possibilities of touch screens built into household network appliances. This includes grocery lists on touchscreens on refrigerators in the kitchen, health and beauty aids in the rest rooms, and home and automobile maintenance in the garage.” Once again, audiovisual control manufacturers are looking far past the entertainment and presentation technology fields that they thrive in, to the enterprise-wide control of many types of components and systems in a multiplicity of environments.

There are some fascinating examples of the potential for metacontrol. The first one, well within the current capabilities of software and hardware, involves multi-city videoconferencing meeting scheduling. A busy executive, instead of having an assistant call numerous meeting participants, room scheduling secretaries, catering services, audiovisual technicians, IT personnel, videoconference bridge services, etc., uses metacontrol to organize the entire event. Using one web-browser interface, the executive selects the required date, time, recipients, and meeting requirements. Metacontrol takes over by sending invitation emails via Outlook, booking the meeting rooms, configuring the MCU for the multipoint call, sending emails with the refreshment and food requirements to the catering services, alerting the audiovisual group of the pending event, and alerting the security department of the level of executives attending at each location. Metacontrol, at the time of the meeting, turns on the audiovisual systems in each of the videoconferencing rooms, dials or establishes IP connectivity between the CODECs, and configures the system for an audioconference. The meeting may now take place.

Metacontrol has posted the meeting on the master web page for each of the meeting rooms. It has listed the meeting on the displays outside each room, and on the master display on the floor of each conference center. During the meeting, a network administrator may browse into any room, view the camera signals and the electronic presentations, and be available on a help-desk basis. Participants have “help” buttons on their screens to access this administrator, who may take control of their system remotely if necessary. But metacontrol does not stop at the end of the meeting. When the meeting moderator inputs that the meeting is finished, from the local control system interface, metacontrol performs the required cleanup functions. It logs the usage of each room and the equipment for maintenance and equipment use tracking purposes, logs the bandwidth, time, and successfulness of the videoconference equipment, connections, and MCU, calculates the “charge-back” billing for the call and meeting, and submits a report to the accounting department for use in tracking all expenses associated with the meeting. Metacontrol has also collected the notes from all of the interactive electronic whiteboards used in the videoconference rooms, and emailed the files to all of the participants for their record of the meeting. It has also digitally recorded the meeting and saved it on the company file server.

Another completely different use of metacontrol occurs in the home. The home control system, connected to the refrigerator and the pantry, has been logging the food inventory continuously via barcode scanning as items are added or removed. The busy executive, upon arriving home, wishes to know what dinner may be prepared with the available ingredients. Metacontrol offers a list of the possible recipes, via the touch screen on the refrigerator. The executive is also interested in preparing a particular dish for the next day. The portable web browser screen is used to browse through recipes, from the comfort of the living room, and when one is found, the available items are evaluated. Missing ingredients are ordered through the Internet to a delivery service. The next day, all items are delivered, logged, and cooking can begin!

Obviously the sophistication of these scenarios supposes that extensive programming has been performed to set up the possibilities. The final level of metacontrol is one of the final levels of artificial intelligence: that the systems may learn from the patterns of behavior of the users, adapt to these behaviors, and modify, predict, and even anticipate future behavior. Although we are a way off from these possibilities, it is the groundwork of the systems and program designs of the present, along with the standards being developed today as described above, that are paving the way to this fantastic future.

The promise of metacontrol should be of interest to technology professionals of all types who are interested in audiovisual and computer industry trends. Those who have the responsibility of planning, designing, implementing, and managing audiovisual systems must understand the ramifications now, as to how the newest technologies can be used for operational cost reduction and administrative simplification. The benefits will certainly be found in the ability to manage a growing number of systems, with dwindling resources and increasing demands. This ease-of-use and satisfaction with the technology will give users confidence and successful audiovisual experiences, which ultimately are the return on investment that are required to support metacontrol.

The Application of Business Models to Distance Education as a Result of Experiences with Interactive Television

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Abstract

In this paper, the authors outline the experience of teaching and learning in an interactive television (ITV) classroom. Both the instructor and the students experienced significant challenges. The authors relate ITV, thought of as a mature technology, to product life cycles and business models. Business models focus on expectations of clients, standardization of a process, performance, and efficiency of product delivery. These elements are typically present when a product is in the mature stage of the product life cycle.

Introduction

Educators have taught courses in interactive television (ITV) classrooms for quite some time. These interactive distance learning classrooms are typically equipped with two-way audio and video and connect at least two sites: the main site at which the instructor is housed and one remote site (Reed & Woodruff, 1995). Some of the universities that use this technology own the connected sites; other institutions form a consortium consisting of sites owned by a number of universities or colleges.

Many educational institutions have adopted the technology. Interactive television-based classrooms clearly have been at the maturity stage of the product life cycle for some time. The vast explosion of the World Wide Web and Internet technologies have led to an increase in Web-based course offerings and, therefore, driven ITV classrooms into the maturity, perhaps even into the declining, stage of the product life cycle.

Background

The institution is a comprehensive university located in Minnesota and has approximately 15,000 students. The university has been involved in ITV for approximately twenty years and is a member of a Distance Learning Network. The network consists of two separate networks and has six members and numerous sites. Members are responsible for providing technical support to users and for the maintenance of the classrooms.

Several of the ITV classrooms at this university are less than three years old and are equipped with video cameras, a smartboard, and one computer at the instructor station. The instructor carries a microphone, and the room is equipped with microphones in the ceiling. The remote ITV classrooms are owned by colleges or universities within the Minnesota State Colleges and University system and also have video cameras and microphones. This technology allows the transmission of real-time compressed audio and video. Some of these classrooms are equipped with a computer; other classrooms are not.

The cameras in all ITV classrooms are voice activated and allow for interaction between sites. However, the instructor is only able to view one of the remote sites at a time if more than one remote site is connected with the main campus. On the other hand, audio is transmitted from all remote sites. Instructors control the volume or may mute the microphone; students at the remote site may mute their microphones. The instructor has the capability of switching between two cameras at the main campus: one camera either displays the instructor or desktop applications in use; the second camera shows the students facing the instructor station.

Many students find an ITV course convenient because it eliminates the need for commuting to a distant campus. Individuals who reside in rural areas might not have access to the courses if they were not offered via ITV. Also, there are several disadvantages to this delivery system. One disadvantage is the limited instructor-to-students and student-to-student interaction deemed so important in distance education (Moore & Kearsley, 1995). Another drawback is the dependency on technology, which is the case in any technology supported distance education setting.

Experiences in the ITV Classroom

The instructor who taught in the ITV classroom of this university during Spring Semester 2003 had previously taught in this educational setting. He had taught the course many times and used well established course materials such as a syllabus, activities, and assignments. The course taught was a requirement for a school media licensure, and four remote sites were connected to the campus where the instructor was located. Fifteen students were enrolled in the course. One of the sites had only one student present.

Instructor

While teaching this ITV course, the instructor experienced many frustrations associated with the technology. Numerous times, he entered the classroom and found not all sites were connected. During the first class session, one site did not come online until one hour after the session had begun. The instructor and students at the main site had difficulties in hearing comments of students at remote locations on a continuing basis. Students at the remote site did not fare much better. The instructor arrived approximately 15 minutes before class started in order to ensure that the technology was working properly. He never knew what to expect when he entered the classroom. During most class sessions, the technology did not work as expected. In fact, according to him, the technology got in the way of teaching the course. Negative experiences continued throughout the semester for the instructor and for the students. While these may have been isolated problems not typical of most instructors' ITV experiences at this university, the expectation is that these issues should not occur with a product that has entered the mature stage of the product life cycle.

Students

At the end of the semester, students completed a course evaluations questionnaire. Items on the questionnaire related to the technology, the instructor, and the overall ITV experience. The majority of respondents (82%) indicated that they strongly disagreed or disagreed that the ITV system was always properly working at the beginning of class. Twelve percent of students did not think the classroom had used was comfortable and well equipped. However, at least 92% agreed or strongly agreed with positive stated items used to rate the quality of the instructor.

Participants also were asked to offer suggestions and provide other relevant comments in the form of open-ended questions. When asked to describe their ITV experience, four students indicated that they were able to take the ITV course because of convenience. Three students complained about the poor sound quality and mentioned the audio and video were not synchronized. Other comments included that ITV is not the best learning environment, too many remote sites were connected, daily troubleshooting was disappointing, and that the technology used in a technology-based course was not working. The most frustrating of the elements the class reported was clearly the technology—technology problems and audio difficulties. One student wrote, "I was greatly disappointed in having to turn on and troubleshoot ITV every time I came to class . . . . But it is still better than driving to the university's campus." Another student wrote, "I found it to be convenient in that I did not have to drive, but something does get lost in the remoteness of it all." However, students also commented they appreciated having ITV courses as an option, they would take another ITV course, and that it was a good experience overall. Recommended improvements by respondents were: decreasing the number of connected sites, using better equipment, improving the sound system and technical support, and rotating the instructor between sites.

Product Life Cycles and Organizations

Based on the instructor and student experiences, the authors wanted to know how this experience might fit into a product life cycle. The four stages of the product life cycle are: (1) introduction, (2) growth, (3) maturity, and (4) decline. When a technology product enters the maturity stage of the product life cycle, the product has moved from cutting edge technology to an established technology tool. At this stage, products usually have been improved through the addition of new features (Peter & Donnelly, 1998). The investment of resources is decreased because the majority of resources were allocated during the introduction or growth stage. One can assume a product in the maturity stage is consistent, predictable, and reliable. In case of ITV classrooms, students and instructors should expect to receive or deliver a good product, respectively.

Not only do technologies go through a life cycle, organizations go through life cycles as well. As technologies and organizations reach the mature stage, one expects predictability, efficiencies, and customer satisfaction. Business owners have the same goal, because the profitability of a business is the highest at the maturity stage.

In business settings, the goal is to reduce the time a product takes to reach the maturity stage. Franchising offers a model for trying to establish a mature business in a short and predictable manner. Here, franchise owners use standardized processes in order to deliver the same quality product at individual locations. They make extensive use of efficiency, economies of scale, and standardization, and promise the consumer the matured experience they expect.

Rationale for the Application of Business Models

Whenever consumers purchase a product, they have certain expectations pertaining to quality, efficiency, and standards. In an educational setting, students have the same expectations. When instructors use new, emerging technologies, difficulties and occasional glitches are expected. However, when they use technology that has been well established and coined reliable—systems or tools in the maturity stage of the product life cycle—they have expectations that the delivery system will be functional the majority of the time.

Business models focus on expectations of clients, standardization of process, performance, and efficiency of product delivery. Perceived quality is one major component in branding strategy (Peter & Donnelly, 1998). Without the application of a business model, every good experience pertaining to a product is a result of random events and, therefore, cannot be reliably duplicated. Is it possible that we can learn from the business world and apply these models in educational institutions? Can we gain from examining these business practices and integrate them? The franchise model is particularly interesting and could be applied in the adoption of technologies and development of support materials and services.

Many books address issues businesses face at various stages. Gerber (1995) examines how entrepreneurs successfully start and grow small businesses, and addresses lessons learned from franchising. We could argue that faculty who develop new courses or experiment with integrating new technologies into their classrooms could be thought of as entrepreneurs even thought they do not face the large risks true entrepreneurs face. However, their goal should be to move their product (teaching) to a mature, dependable, and efficient model.

The advantage of following a business model in education is that the *institution* gains efficiencies in the mature technologies and services so that *instructors* have time to explore and experiment with emerging technologies and services. For example, the instructor who taught in the ITV classroom during Spring 2003 devoted a lot of time to just surviving in the ITV classroom instead of exploring Internet capabilities. What should have been routine tasks required the same time and effort as would adopting and exploring new technologies.

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Reinventing Education3
Visioning and Developing a Model for Pre-service Education Using IBM's Learning Village/Riverdeep Technology

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Abstract

The Carolinas Collaboration, a consortium of public schools and institutions of higher education in North, and South Carolina, was recently awarded a 1.5 million dollar Reinventing Education grant from IBM. Using IBM technologies such as Learning Village and River Deep the Carolinas Collaboration will implement standards-based reform, to improve teacher education programs, and to increase the effectiveness of the North Carolina and South Carolina statewide professional development initiatives.

Introduction

Since 1994, Reinventing Education has been the centerpiece of The International Business Machines (IBM) Corporation's commitment to educational improvement, supporting school reform efforts and higher student achievement through the development of innovative technology solutions. The Reinventing Education initiative has provided significant grants to school districts throughout the United States to reinforce its mission to make a unique and meaningful difference in our schools. This year a consortium of public schools and Institutions of higher education in North and South Carolina received an IBM Reinventing Education 3 (RE3) Grant in the amount of $1,500,000. This consortium, known as the Carolinas Collaboration, consists of the Charlotte-Mecklenburg Public Schools in North Carolina, six school districts in South Carolina (York 1 Public Schools, York 2 Public Schools, York 3 Public Schools, York 4 Public Schools, Chester Public Schools, Lancaster Public Schools), as well as several institutions of higher education including the University of North Carolina at Charlotte, Davidson College, Johnson C. Smith University, Queens University, and Winthrop University.

Improving Education Through Professional Development

The Carolinas Collaboration seeks to implement standards-based reform, to improve teacher education programs, and to increase the effectiveness of the North Carolina and South Carolina statewide professional development initiatives. To this end the Carolinas Collaboration will use the implementation of technology as an integral component to improve the quality of teacher pre-service and in-service programs. This will be facilitated through the development of new and innovative teaching and learning methodologies via the innovative implementation of IBM Learning Village/River Deep technology.

Learning Village and Riverdeep in the Classroom

Learning Village was originally developed by IBM to provide educators with a web-based platform for instructional development. This year IBM has announced the development of a significant upgrade to Learning Village known as Riverdeep. This system utilizes on IBM's Websphere technology. By moving to the Riverdeep platform educators will have a more robust system that conforms to the latest Internet content delivery standards.

The vision for the New Teacher Preparation Program initiative is to develop the capacity of pre-service and classroom teachers to plan and implement effective instruction that will increase student achievement. The major challenges being addressed are that beginning classroom teachers are not adequately prepared to meet the demands of the first years of teaching and teacher retention. This problem centers on new teachers' needs to better understand and apply effective instructional planning and best practices. The solution is ongoing, clear communication between teacher preparation programs and school districts regarding needs in instructional planning and articulation on the skills needed for effective teaching. To meet this need and fulfill this vision the Carolinas Collaboration will work together to align instructional planning and delivery across all teaching levels, including pre-service teacher education then use Learning Village/River Deep to help pre-service teachers develop instructional programs for implementation in the classroom.

Using Learning Village/Riverdeep as a communications tool will strengthen teacher candidates' capacity to develop lesson plans, utilize scoring rubrics, and utilize assessment tools. These are just some of the components of the Instructional Planner, the core element of Riverdeep. Riverdeep will also contain features that will facilitate the assessment of pre-service teacher candidates as they progress through their course of study. Using Riverdeep, a model will be developed that will help Colleges of Education prepare pre-service teachers for the classroom while meeting the new NCATE Comprehensive Candidate Assessment Plan though the implementation of an electronic assessment plan.

This presentation will highlight the model being developed by the Carolinas Collaboration and how that model leverages the new features of Riverdeep to help teacher candidates meet the challenges of today's classroom.

Return On Investment in Nature Conservation—Evaluating Leadership Development in the World Wide Fund for Nature

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Background

The World Wide Fund for Nature (WWF) is one of the world's most active and professional conservation organizations. Since 1961, WWF has been involved in programmes around the world to try and restore the balance between human activity and nature. Over those 40 years, WWF and other environmental groups can claim some outstanding successes. But, the bottom line is that while WWF may be winning some battles, they are certainly losing the war. The Living Planet Index (2002), which tracks macro-level global biodiversity, shows that the world's species and habitats have declined 35% over the past 30 years. The world will be biologically poorer tomorrow than it is today. The blunt truth is that we must do more.

Conservationists face increasingly complex and large-scale challenges. They need to excel in technical areas, and also need to be able to engage and motivate partners: civil society, local and national governments, business and industry, the media and local communities. WWF needs to develop and motivate their teams and networks. In short, conservationists need a complex set of skills to carry out our jobs effectively. Above all WWF needs leadership. As one College participant put it, 'This is not just a biologist's job anymore'.

The WWF College for Conservation Leadership was conceived in 1998 to help WWF and its partners meet these challenges and to develop the leadership skills needed to start winning the war.

Programme Design

The WWF College for Conservation Leadership aims to enable individuals to recognize, challenge, and develop leadership talent in themselves and others in order to improve the impact of nature conservation. The College strives to do this by delivering individualized online learning programmes, and creating learning environments to share challenges, knowledge, and approaches.

The College is an interactive learning network. It combines new technology with traditional face-to-face training and offers a unique learning environment. Participants learn from each other, and analyze and improve their own performance to become better leaders and thereby achieve greater conservation results. The College promotes the ideas of self-directed learning, peer learning, learning on the job and continual improvement.

The Conservation Leadership Programme is an 18-month programme with modules around four themes that have been identified as important for leaders in nature conservation: *Leadership and Management*, *Strategy and Planning*, *Campaigning and Advocacy*, and *Communication and Networking*.

The programme is designed and developed in such a way that it can easily be part of the workday, with a time investment of an average of two to four hours a week, and modules that can directly influence the way that participants do their work. The College brings people together from around the WWF Network to share experiences, discuss new trends, and help develop the competencies that make up a leader in conservation. The College is not a just a place were participants take. They already have a lot of knowledge and skills which they bring to the College. The College is THE place to learn, share, and lead!

Each year, through a competitive selection process that involves both the applicants and their supervisors, two groups of 25 participants, balanced in terms of geographic regions, gender and functional specialties, start the Conservation Leadership Programme. The programme begins with a one week workshop which sets the stage for the rest of the 18 months. Through role plays, exercises and discussions, this interactive workshop introduces the themes of leadership, communications, and information communications technology. Participants evaluate themselves on the key competencies within each of the four themes, and then in consultation with a facilitator, plan a customized study programme based on their needs. This week also provides an opportunity to get all participants familiar with the College' online learning environment, the College Campus.

A primary task of the facilitators (both in the workshops as well as online), is to ensure a two-way flow of learning. Rather than having an expert stand in front of the group and lecture on the 'right' way to do things, participants are encouraged to apply what they know and share ideas with other participants to learn from each others' experiences, add some fresh perspectives to their own point of view, and thereby increase the skills in their toolkit. This has the added benefit of building a greater capacity for learning and problem-solving by using their networks in the future. Participants are exposed to new theories and models that they are then asked to apply in their daily work situations. Following the opening workshop the programme continues with nine months of online distance learning using the College website. Participants select and take part in a series of six-week modules, requiring 2-4 hours of study per week. These modules are facilitated by a content expert, who reviews online assignments, answers questions and moderates discussions. Participants must satisfactorily complete all assignments to finish a module. There are two core modules, Leadership Skills and Effective Communications, that all participants have to complete. Next to the core modules, participants need to complete at least five elective modules that can be selected from a list of sixteen modules spread over the different themes.

The group comes together again mid-way through the programme, for another week-long workshop. This is an important time to review progress, revise the study programme as needed, and address any problem areas. Also during this interactive workshop participants work on leadership, teambuilding, strategic partnerships and campaigning through role plays, exercises and a group project based on a real-life case study from the region of the workshop location.

This second workshop is again followed by a further nine months of online learning. At the end of the 18 months, successful candidates receive a Certificate of Conservation Leadership.

The College started with a pilot phase of four groups. Even before Group 4 finished, WWF's senior management decided to continue the programme. Since then, five more groups have started their 18-month programme. Of the first four groups with a total of 70 participants, 30 successfully completed the programme. Of the participants that started and finishes since the pilot phase, 75% successfully completed the programme. A handful others had valid reasons to ask for extension of their programme and may graduate in the next couple of months. Reasons for allowing extensions are amongst others: health problems, family crises, and module scheduling conflicts.

Purpose of the Evaluation

In an ideal world, evaluation is planned before or during the design of a programme. As in many cases, this was not done in the design of the Conservation Leadership Programme.

Until now, reporting of successes in the College was very activity based. For instance locations of workshops, numbers of participants starting their programmes and how many complete the programme is reported. Some post-module and post-workshop satisfaction ratings are available, but little is known about the quality of the programme—or more important—of the participants' learning. And are new knowledge, skills, and attitudes actually used? For the College management, the main questions are: a. are the right things being done? and b. are things done right?

At the same time, the global trend of accountability of all kinds of processes is not surpassing non-profit organizations such as WWF. Senior management of the organization is starting to wonder what the impact is of sending participants to and funding a training programme. Can the impact of a leadership training on nature conservation be measured?

This evaluation study is a first attempt in WWF's Conservation Leadership Programme. The main questions in this evaluation study are: a. are participants learning the offered knowledge and skills? b. are participants applying them in their work? c. what is the impact on WWF 's critical organizational measures? and d. can the impact be translated in monetary return?

Method

In the following paragraphs the method of the evaluation study is describe. First, the theoretical background is explained. Next, the translation is made to the current study: subjects and instruments are described. Finally, the mechanism for isolating the effects of the programme on the result is clarified.

Measuring ROI of human resources, training, and performance improvement programmes is becoming common in businesses around the world. Increased emphasis on understanding inefficiencies in other sectors such as the health-care, non-profit, and public sector, but also building accountability into their processes causes these sector to adopt the ROI process (Phillips, 2001).

This study used a five-level evaluation process, based on Kirkpatrick's four levels of evaluation (Kirkpatrick, 1994), and Jack Phillips' return-on-investment (ROI) process (Phillips, 1997). This process enables the measurement of reaction and learning (Level 1 and 2) at the end of workshops and modules. It also enables the measurement of job application of knowledge and skills (Level 3) and organizational results affected by the programme (Level 4). In addition the process offers a tool to calculate the programme's ROI (Level 5). Phillips (1997) emphasizes that the higher levels can not be seen and measured without paying attention to the lower levels.

Evaluation according to Phillips (1997) is much like putting together a puzzle with five pieces: a. The evaluation framework, which defines the levels at which programmes are evaluated as described above. b. The ROI model. Figure 1 shows the ROI methodology model, depicting systematic steps to ensure consistent application of the methodology. c. Operating standards and guidelines (see Figure 2) that build credibility in the process and support a conservative approach to ROI evaluation. d. Practice provides support for the final piece: e. Implementation, bringing together the pieces of the puzzle.

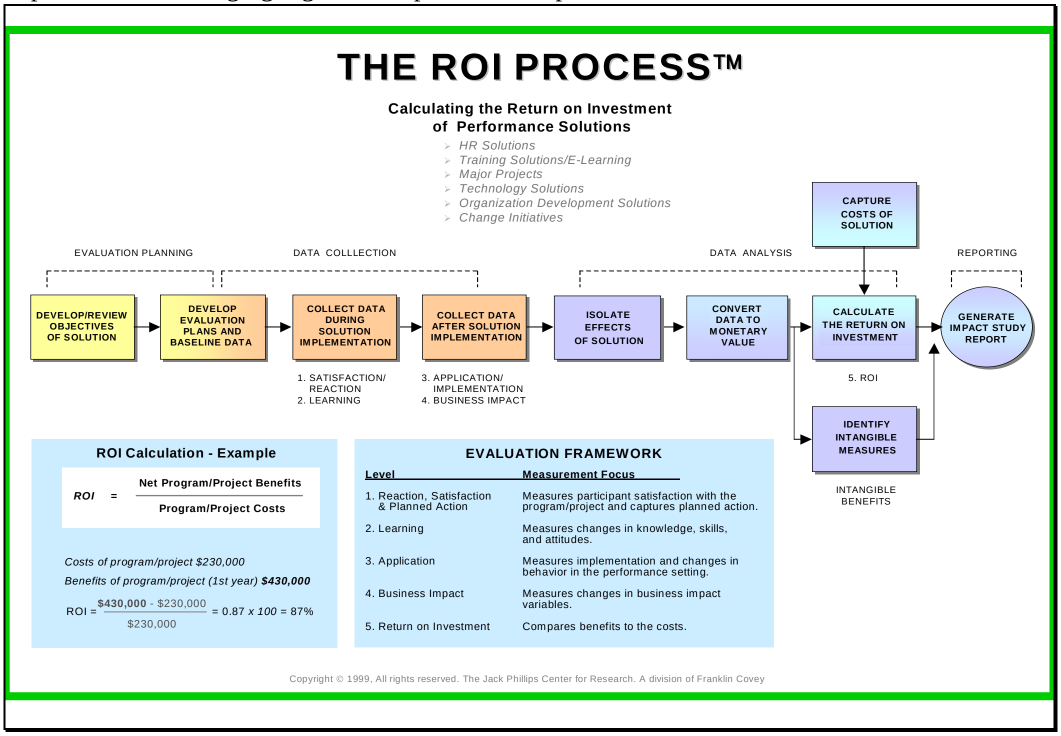

Figure 1. The ROI process (reprinted with permission of Jack Phillips)

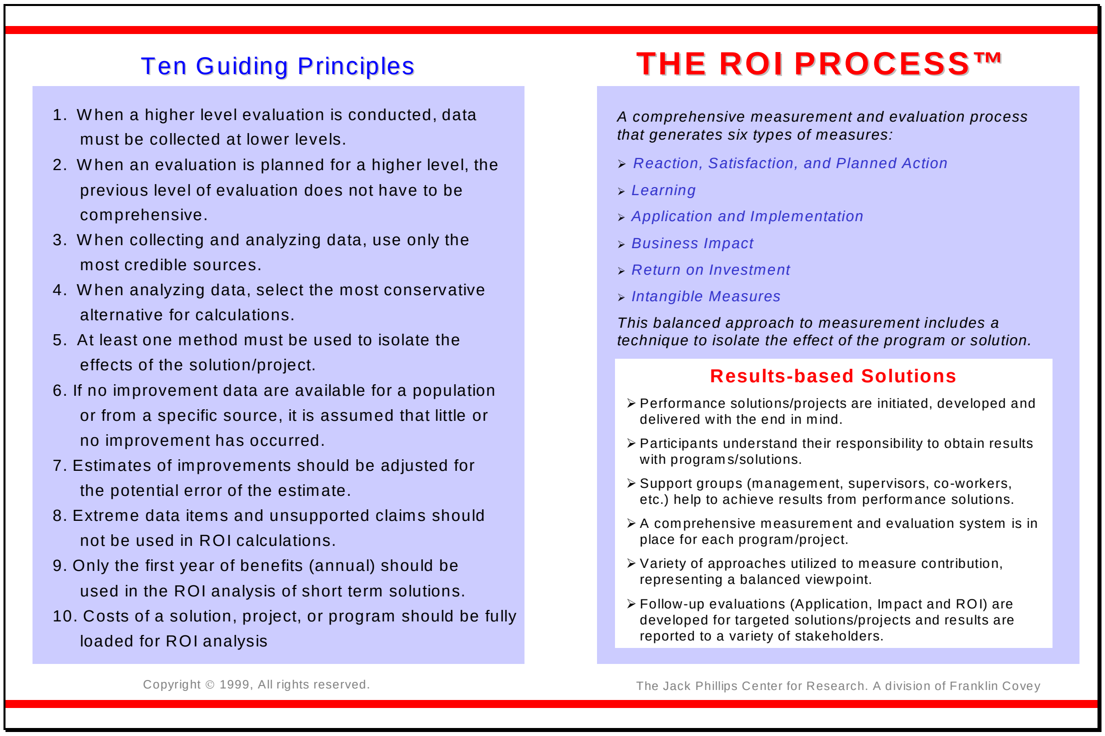

Figure 2. Ten guiding principles of the ROI process (reprinted with permission of Jack Phillips)

As mentioned before, the evaluation of the Conservation Leadership Programme was not planned when designing and developing the programme. Thus no assessment of knowledge and skills before participation was collected. Still the ROI process used in this study provides useful tools to measure learning, application and impact after the programme. And management of the College decided that this first effort is preferred over no effort to evaluate.

Subjects

All 44 participants from Group 4 and 5 of the Conservation Leadership Programme were included in the study. The participants, 29 male and 15 female, are spread over 27 countries in Asia, Africa, Central and South America, and Europe. They have a variety of functions in the organization, such as communications, finances, human resource management, and different functions in nature conservation units and projects. Group 4 graduated one year before receiving the questionnaire. For Group 5 this was three months. The groups were the most recent graduates of the programme.

Instruments

Reaction data are continuously collected after each workshop and each online module. In the case of a workshop on paper, after an online module with an online form. Some focus on learning of new skills is included in these forms, but questions about Level 2 were also included in the questionnaire that is described next.
A questionnaire was developed to measure results at Levels 2 through 5. On a five-point scale, participants were asked to identify their degree of success in achieving the learning objectives for the different competencies underlying the programme (Level 2) and list the top five most frequently used competencies. For Level 3, application of skills, participants were asked to indicate on a five-point scale the perceived change in a list of skills that are used in the College to characterize the different competencies. This level also included a top-five of skills that impacted their work most. For impact (Level 4) a list of measures was developed in cooperation with the Steering Group of the College. This group—in the College called ‘Theme Owners’ is among others responsible for guarding the quality of the programme in the different themes of the College programme, and consists of senior management members from across the WWF-Network. Measures were combined in 8 categories: financial income, financial cost savings without loss of conservation impact, Communication and media, Campaigning, Networking and partnerships, Policy change, Conservation, Innovation and learning. Within these categories, indicators focus on hard data such as output, quality, costs, and time.

For ROI (Level 5), two types of data are necessary, programme costs and programme benefits. Costs for the participants include: salary costs for the time spent on the programme including benefits, tuition, and travel, accommodation, and meal costs for two workshops. For benefits, participant were asked to reflect on the indicators of the impact question and select three or more accomplishments that can be converted into monetary value.
After two months and two reminders, a short survey was sent to non-respondents. In this survey they were asked to indicate what the main reason was why did not manage to return the questionnaire.

Isolation method

The most critical step in the evaluation process is one that is often overlooked: isolation of the effects of the programme (Phillips, 1997; Phillips, 2001). What part of the impact can be attributed to the intervention, in this case the Conservation Leadership Programme, and what other influences may underlie the results? Phillips (1997) and Phillips (2001) describe several techniques that have been used to address the issue. In the present study, participant estimates of programme impact have been used.

For each benefit listed in the questionnaire, participants were asked to estimate the percentage of the improvement that was actually influenced by the application of skills learned in the Conservation Leadership Programme. Also, participants were asked with what level of confidence they made that estimate. For the calculation of ROI the most conservative estimate of the monetary value was used.

For example, if a participant estimated a monetary benefit of $4,000 and 60% of the improvement is due to the Conservation Leadership Programme. The participant is 80% confident about that estimation. Then the most conservative estimation of the benefit will be 60% x 80% x $4,000 = $ 1.920.

Results

Of the 44 questionnaires, 15 were returned. Only nine of the participants answered all questions. The other six answered the questions up until the questions on monetary values. Participants used comments like “hard to estimate”, “there is no reason to calculate this”, and “most of it is qualitative but still important” as arguments to stop their answers at Level 4. The difference in time between the end of the programme of the two groups and filling out the questionnaires did not show a significant difference in the results. Therefore the results are combined.
In general participants react positive to this programme. One skill that is taught in the Conservation Leadership Programme is to be able to provide colleagues and staff with constructive feedback. Participants learn this skill during the first workshop and will use it in the evaluation forms. In Table 1, the average ratings of the main themes of the workshops are given for both groups. It is not possible to list all evaluation results of all modules.

Table 1. *Selected reaction data for College workshop main themes*

Kick-off Workshop		Group 4	Group 5
	Leadership	3.72	4.57
	Communication	4.47	4.75
	Vision	4.11	4.63
	ICT	4.83	4.21
Follow-up Workshop			
	Strategic partnerships	4.32	4.20
	Networking	3.90	4.24
	Campaigning	4.55	4.50
	Teambuilding	4.00	4.45

Participants report valuable learning across the themes of the programme. The ten competencies with the highest degree of success to reach the learning objectives are listed in Table 2. The lowest average score on any of the items in this questions was 3.7. In Table 3 the competencies applied most on the job are listed. Motivating and directing individuals and themes, a competency within the Leadership and Management Theme of the programme was mentioned by eleven of the fifteen respondents. Vision and Strategic partnership each by ten participants.

Table 2. *Top 10 Level 2 data: Degree of success in reaching learning objectives*

Competency	Score
Capitalizing on knowledge sharing	4.4
Developing and communicating a vision	4.3

Using communication to procure results effectively	4.1
Motivating and directing individuals and teams	4.0
Mobilizing the Network and other NGOs	4.0
Recognizing and using media opportunities	4.0
Managing a project through all its cycles	3.9
Building and managing strategic partnerships	3.9
Creating awareness and educating others	3.9
Using communication technology effectively	3.9

Table 3. Top *3 competencies applied most on the job.*

Motivating and directing individuals and teams
Developing and communicating a vision
Building and manage strategic partnerships

When looking at the skills applied on the job (see Table 4), the skills learned in modules in the Leadership and Management Theme have improved most. The six most improved skills are found in this theme, before skills in Strategy and Planning, and Campaigning and Advocacy. In Table 5 the four skills that had the biggest impact on their job performance are listed. Here also leadership skills were reported most, followed by campaigning and advocacy skills.

Table 4. Top *10 Level 3 data: Level of improvement of applied skills*

Theme	Skills	Score
L&M	Establishing clear directions and objectives	4.1
L&M	Inspiring and motivating	3.9
L&M	Finding common ground and getting cooperation	3.9
L&M	Formulating and communicating a vision	3.8
L&M	Empowering others	3.8
L&M	Sharing wins and successes	3.8
S&P	Maintaining a positive relationship with potential partners	3.7
C&A	Presenting case clearly	3.7
L&M	Analyzing strategically	3.7
L&M	Communicating clearly	3.7

L&M: Leadership & Management; S&P: Strategy and Planning; C&A: Campaigning and Advocacy.

Table 5. *Top 4 skills having most impact on the job.*

L&M	Analyzing strategically
L&M	Formulating and communicating a vision
C&A	Using relevant communication based on target audience
C&A	Developing and implementing appropriate campaigns

Table 6. *Top Level 4 data: Degree of influence of training on organizational measures*

Category	Measures	Score
I&L	Knowledge and experience shared with team members	4.2
C&M	Quality of message – style, format, packaging	3.8
C&M	Reach – number of target audience exposed	3.3
I&L	Time spent on training and development	3.2
C&M	Continuity – distribution of messages over the year	3.1
N&P	Dialogue with potential partners established	3.1
I&L	Knowledge and experience shared on the web	3.0
N&P	Strategic partnerships established	2.9
CON	Magnification achieved	2.9

CON	Conservation Capacity	2.9

I&L: Innovation & Learning; C&M: Communication & Media; N&P: Networking & Partnerships; Con: Conservation

Table 7. *ROI Calculation*

	Group	Benefits	Costs	CBR	ROI
1	4	-	15,676.32	-	-
2	4	-	16,898.40	-	-
3	5	-	13,826.00	-	-
4	4	15,200	6,312.80	2.41	141%
5	5	38,321	14,108.36	2.72	172%
6	5	20,000	15,330.00	1.30	30%
7	4	-	14,710.40	-	-
8	5	-	11,290.00	-	-
9	5	67,500	24,335.91	2.77	177%
10	5	56,290	15,663.70	3.59	259%
11	5	-	13,882.00	-	-
12	5	4,955	12,300.00	0.40	-60%
13	5	14,155	6,434.60	2.20	120%
14	4	34,347	6,940.00	4.95	395%
15	4	8,000	7,705.00	1.04	4%
Total		258,768	195,413.00	1.32	32%

CBR: cost-benefit ratio.

For Level 4 data, the participants were asked to indicate to what extent they thought that application of knowledge and skills had a positive influence on organizational measures. Measures in eight categories were listed. Table 6 shows the measure with the highest degree of influence. Results show that items in the Innovation and Learning, and the Communication and Media categories score best followed by indicators in Networking & Partnerships, and Conservation.

In Table 7 the calculations for the ROI are given. For each of the fifteen participants the costs and benefits that they reported are listed. Next to the ROI the cost-benefit ratio (CBR) is given. CBR is a different way of calculating return. The CBR is calculated by dividing costs by benefits. ROI is costs minus benefits divided by benefits. For the six participants who did not report a benefit, a ROI could not be calculated. By default their ROI is -100%.

The figures are a representation for the ROI of the individual participants. The figures in Table 7 do not include development costs and other costs the College has. For the individuals working in their individual offices and projects these are their real costs. When College overhead costs are not included, the ROI for this group of participants is 32%.

For WWF as an organisation the programme costs should be included. The tuition paid by the participants does not cover all costs. The organisation invests in the developments of its workforce. When these costs are calculated per participant, the ROI for the fifteen respondents would be -29%, or for the whole group of forty four participants -76%.

Table 8. *Non-respondents survey*

Reason for not responding	Frequency
no time	18
other engagements	7
other priorities	4
the questions are too difficult to answer	5
the questions are irrelevant	0
I could not open the document	1
I didn't receive the questionnaire	3

Twenty three out of twenty nine non-respondents, reacted on the survey sent two months after the questionnaire was distributed. More than one answer was possible. The main reason for not responding was time. Only a few participants thought the questionnaire was too difficult.

Discussion and Conclusion

The main questions in this study were if participants in the College are learning and applying the necessary knowledge and skills from the programme, what the impact of this learning on the organization is, and if ROI can be calculated for these impacts.

Participants reported learning in all competencies of the Conservation Leadership Programme. On a five-point scale, participant rate their own learning between 3.7 and 4.4 on 13 different competencies. When comparing the competencies that participants list as being used most on the job (see Table 3) and the level of reaching the learning objectives of these competencies (see Table 2), it becomes clear that the most used competencies not always score the highest in the degree of success of learning. Developing a vision for conservation and reaching conservation targets through strategic partnership are currently emphasized as two of the main strategies for achieving WWF's goals. The difference in scores in Table 2 are not very big. Further analysis is necessary to determine if the content of the programme should be adjusted to increase learning in these key areas.

In the description of the background of the College, it was mentioned that "above all, WWF needs leaders." The results of this study suggest that participants have improved their leadership and management skills in their daily work. Eight skills in the Top 10 Level 3 data in Table 4 are skills learned in modules from the Leadership and Management theme. The Conservation Leadership Programme appears to achieve its mission in developing leadership talent.

The biggest impact of the College programme on achieving WWF's key organizational measures are knowledge sharing and quality of communication (see Table 6). In the Top 10 list, many learning and communication indicators score high. Conservation measures appear in 9-th and 10-th position in this list. The two categories listing financial measures (income, and cost savings) do not appear at all in the top, just like policy change, and campaigning.

The fact that the participants were part of a knowledge sharing experience influenced this score. And in the College programme, communication is the topic of one of the mandatory online modules. This could explain the high score in these measures. Financial benefits and savings may not be so obvious for the participants. Applying for funds from either internal or external sources takes time. Also budgets are prepared once a year and there are limited possibilities for revision. This may cause that impact is hard to measure on the short term, but could still have an effect after a year. Still the College should further investigate if the programme can be improved to support the impact on the less influenced measures.

The question if ROI can be calculated should be answered with yes. However it is not for everyone in the group of respondent an easy task. Participants who reported financial benefits from the programme can explain well what the basis is for their estimation. For example: new products developed, project proposals approved, new strategic partnerships, time savings, cancellation of projects, and effects of new training programmes implemented. When asked what percentage of these benefits are due to participating in the College programme, participants' estimates vary from 30% to 100% with an average of 72%. They are very confident about their estimations. The level of confidence varies from 70 to 100% with an average of 88%.

The nine participants reporting a return in financial terms report benefits that are sufficient for the whole group of 15 respondents. For every dollar that the fifteen spend on participating in the College 1 dollar and 32 cents was returned.

The question remains what distinguishes the nine participants who did report a return in financial terms from those who failed to do so. With current economic uncertainties and an increasing emphasis on accountability, the ability to clearly indicate the impact of certain processes on achieving organizational targets could show to be an essential competency that every Conservation Leader should have. More research will be needed to identify the differences between the two groups.

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Design and Development of an Internet-Based Electronic Performance Support System for Systemic Change in K-12 Settings

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Abstract

The purpose of the Internet-based Systemic Change EPSS is to provide the systemic change facilitators with the tools, resources, and information they need in the process, and accessibility to the other facilitators and communities dealing with systemic change. Creating such a system requires a detailed analysis, comprehensive design and careful implementation stages. We analyzed the requirements for such an EPSS in a previous study. In this session, we present the development and implementation of this endeavor.

Introduction

The purpose of educational systemic change is creating a better educational system than the existing one. Systemic change requires collective effort from people in a specific change context, including community and school. However, these efforts would be void without guidance and planning. Jenlink, Reigeluth, Carr, and Nelson (1996) suggested a set of guidelines offered through a systemic change guidebook to help systemic change facilitators with their change efforts.

An Electronic Performance Support System (EPSS) is a system that provides cognitive support to performers for complex information. Since the systemic change effort is a process including complex information, an EPSS is necessary to support the facilitators of systemic change. The motivation factors for designing an EPSS for the guidebook are increasing the effectiveness of the guidebook and creating a community of systemic change facilitators in educational systems change field. First, the guidebook consists of 26 discrete events that are sequential during the change effort and 18 continuous events that could be at different stages of the change process. Each discrete and continuous event consists of several activities and sub-activities. Each of these activities makes about 10 pages of detailed guidelines, considerations, and tools, which makes the guidebook so thick and heavy that it might not be practical to carry it to many meetings conducted during the systemic change effort. It would also be expensive to copy it for key participants' use. Secondly, changing an educational system in a school district is complex and non-linear process. Obtaining guidance and help from other experts in the field may become crucial in certain stages of the change process. For these two important reasons, the authors of the guidebook decided to produce it in the form of an EPSS, using hypermedia and the Internet. A team of designers and developers started to work on the EPSS by considering the motivation factors for it.

Definition and Characteristics of EPSS

What is EPSS?

Before explaining the developed EPSS project, it is helpful to understand the concept of EPSS and the situations in which EPSS is useful. This section provides information about current knowledge on EPSS in the literature and cases in which EPSS can be used as a performance support tool.

An Electronic Performance Support System (EPSS) is a just-in time performance support tool that is used at the place of performance. The objective of an EPSS is "to provide whatever is necessary to generate performance at the moment of the need" (Gery, 1995). EPSS is also a complete system of performance support tools to accomplish required tasks in the job setting. After the introduction of the computer networks and the Internet, performance support systems became universally accessible and now designers have opportunity to develop Internet-based EPSSs.

Historically, the roots of EPSS may reach to the mid 1940s. Due to rapid growing body of knowledge, Bush (1945) indicated the problems of storage, search, retrieval and use of information for the people who needed specific knowledge from immense amount of information. He explained an imaginary machine, which he called 'Memex'. According to Bush (1945), the Memex would allow people to conveniently access the specific information in large information systems; in this way it would support human beings by enlarging their memory capacity. By doing so, humans could do information retrieval, modification and manipulation faster and better than with conventional methods. From this perspective, Memex may be considered as the ancestor of modern EPSS systems.

The focus of EPSS is to help people perform rather than to learn. Cole, Fischer, and Saltzman (1997) described the term EPSS as providing 'just-in-time' knowledge while performance takes place. By this definition, learning may or may not occur because the main focus is to support performance, not learning (Rosenberg, 1995; Rossett, 1996).

Since the main focus is performance, it is generally agreed that EPSSs have different attributes than instructional systems in many aspects (Cagiltay, 2002). After reviewing the literature, Cagiltay (2002) asserted three main differences between EPSSs and instructional systems. First, the purpose of an instructional system is to contribute to the achievement of certain types of learning outcomes in learning process, whereas the primary purpose of EPSS is to help people perform during the time of the performance (Witt & Wager, 1994). Second, the utilization timing of EPSS and instructional systems are completely different. EPSS is utilized at the time of the performance when the need occurs, on the other hand, instructional systems take place before the performance (Cole et al. 1997). Finally, the structural difference between instructional systems and EPSS is another major distinguishing factor. While instructional systems are well-structured and their content is well-defined toward certain learning objectives, EPSS does not necessarily follow a predetermined sequential path to support the performance (Laffey, 1995).

Brown (1996) lists four circumstances that are best for utilizing an EPSS: using immense amount of information to perform at competent levels, unavailability of experts, high expectations from the workers, and self-directed performers. Reeves (2003) provides a set of questions to determine whether an EPSS is necessary or not for performers in an organization. Reeves (2003) lists following questions to answer the larger question: "Is an EPSS an appropriate solution to this performance problem?"

1. Do performers have easy (better yet, constant) access to computing?
2. Is the task/job that requires support complex enough to warrant an EPSS?
3. How stable is the task/job? (If it changes often, an EPSS may be more appropriate than other approaches that are more difficult to maintain, change, and disseminate.)
4. How critical is the task? What is the cost of non-compliance or poor performance?
5. Is time available for support? (Some tasks are so time-critical that the notion of consulting an electronic performance support system is ludicrous.)
6. Do performers possess the necessary characteristics to use an EPSS in terms of literacy, computer expertise, or motivation?
7. Is turnover among potential users of the EPSS high? (High turnover may often justify an EPSS because an EPSS is often more readily accessible than many forms of training.)
8. Are the logistics of getting people to other approaches (e.g., leader-led training) so complicated or expensive that an EPSS is a more efficient solution?
9. Will the EPSS be used for empowerment of performers or to assure that they comply with specified standards of performance?
10. Is the task frequently repeated? If not, an EPSS may be a sound strategy.
11. Are complex decisions involved in the tasks?
12. Can an EPSS be supported/maintained? How will it be updated?

Considering the context of educational systemic change, the EPSS utilization circumstances provided by Brown (1996), and the questions listed by Reeves (2003), an EPSS is an appropriate solution for systemic change facilitators to support them in the change process.

Characteristics of an EPSS

In the literature, EPSS is defined with different definitions. In parallel to that situation, several authors expressed different views about characteristics and components of EPSSs. As cited in Cagiltay (2002), first, Schwen, Goodrum, and Dorsey (1993) proposed four characteristics for EPSSs: information management, collaboration management, productivity through embedded guidance and work metaphor, and finally a problem solving environment that integrates basic tools, information management, collaboration, and productivity tools in a seamless environment. Secondly, Reigeluth (1999) describes four critical components of an EPSS: a database, an expert system, an instructional system and tools. Reigeluth (1999) defines an EPSS as a computer program that provides support for the performance of a task. According to him, an EPSS usually has four major components: a database, an expert system, an instructional system and tools. These components are explained below:

- *A database*. A storage area of information that is necessary for the experts to perform their tasks. A database should be equipped with appropriate menu interface and search functions for easy accessibility of information when it is needed.
- *An expert system*. A system that helps experts decide on the performance steps or provides guidance to make decisions while the experts completing tasks.
- *An instructional system*. A guidance or help system to show how the EPSS can be used best for the users.
- *Tools*. Parts of an EPSS that help a performer to complete different tasks, such as collaboration, e-mail programs and Web browsers.

According to Reigeluth (1999), a human computer interface system serves as an integrator of these components. The designed internet-based EPSS for systemic change facilitators nests all these components and combines them under a website umbrella. The following section discusses the functional specifications of the designed EPSS and explains each component in detail.

Systemic Change EPSS

Functional Specifications of the Systemic Change EPSS

As discussed above section, an EPSS is an integrated system of performance support tools to achieve certain tasks in the place of performance. The goal of an EPSS is "to provide whatever is necessary to generate performance at the moment of the need" (Gery, 1995). With the wide availability of the Internet and computers, designers have opportunity to produce universally accessible EPSSs, which can be available at any time any place. EPSS for systemic change facilitators has been decided to be accessible via the Internet. The primary mission of the Internet-based Systemic Change EPSS is to provide the systemic change facilitators with the tools, resources, and information they need in the process, and accessibility to the other facilitators and communities dealing with systemic change efforts (Cakir, Tuzun, & Reigeluth, 2002). Considering the primary mission of the system, the final product provides more functions than merely an electronic version of the guidebook.

Prior to the development effort of the EPSS, Cakir, Tuzun and Reigeluth (2002) conducted a detailed needs analysis by following a model developed by Tuzun and Cakir (2002). In this analysis stage, they analyzed the system from four different perspectives:

Organizations' or individuals' needs (clients' needs): What performance, how and in which direction performance will be increased.
User analysis: Demographics and computer literacy level of the potential users.
Scope analysis: Performed in two stages, content analysis and task analysis. Content analysis; what content will be covered in the EPSS. Task analysis; what tasks will be accomplished by using the EPSS.
Technical analysis: Considering the technical aspects of the EPSS such as feasibility of technologies, connection speeds, Internet Service Provider (ISP) software support capability, browsers, and– site address.

Analysis stage was conducted with the two systemic change facilitators engaged with the systemic change process in a school district located in Indianapolis, IN and two designers of the system. Based on the data collected in the analysis stage, functions of the EPSS can be categorized according to EPSS components explained by Reigeluth (1999):

- *The database*. The database consists of several elements of the system. The main part of the database is the guidebook which is also main content of the developed system. Through taking the advantage of various interface technologies, appropriate chunking of the guidebook is necessary in the system. Other content parts of the database are frequently asked questions and resources related to the systemic change efforts.
- *An expert system*. During the analysis stage, facilitators expressed a need for a guidance system that would provide key information and guidance about certain issues that are important during the events of the systemic change effort.
- *An instructional system*. The analysis showed that the content and the required tools to accomplish the tasks needed a system that explained users how to use them.
- *Tools*. Initial analysis showed that a tool that creates a community to exchange information between the facilitators is a necessity for the EPSS. Besides a community tool, a search and print the page tools are required for the system.

Development of the System

The development stage of the systemic change EPSS is a synthesis of the emerged components in the analysis stage. These components were integrated in a human computer interface with using hypertext/hypermedia systems. Three main components are discussed below; interface, content and tools, and tutorial. The systemic change EPSS should be designed with considering the novice computer and Internet users. Dillon and Gabbard (1998) stated that for novice users, hypertext/hypermedia based systems should be highly structured to prevent the 'lost in hyperspace' phenomenon to occur; hence the user interface should be simple, clear and understandable. Content and tools are considered together in the system and discussed in detail below. Lastly, in order to assure that users get the maximum benefit from the system a tutorial component is added.

User Interface Related Components The interface component of the system must facilitate easy navigation and clear orientation for the user. Such a system is designed based on the frame feature of HTML. Using the frame feature enables designers to make changes on the interface independently from the content. The interface consists of two frames, a navigation frame on the left and a content frame on the right. While navigation frame contains the links in the EPSS, content frame displays the information that is directed from the navigation frame.

1. Navigation Frame: The navigation frame takes place on the left side of the system's interface. It is designed based on JavaScript from the http://www.treemenu.com site. One advantage of the tree menu is that the structure of tree menu navigation provides a clear sense of orientation for the users. By using the navigation's structure, a user can reach any part of the system without losing the track of where s/he is in the site. The usability tests showed that the users had clear sense of orientation without thinking too much about where they are. Tree menu provides another advantage for updating the site, since the content and navigation frames are independent, any addition or removal from content or navigation frame can be implemented within very short time without rigorous experience on HTML.

2. Content frame: The content frame is placed on the right side of the interface. This frame contains the title, search, print, contact and sitemap functions. The title indicates the name of the section in the site. Under the main title, functional tools, search and print page take place. Although the navigation of the system is clear and easy, sometimes it may be difficult to find specific information. By typing the keywords in search box, a user can reach required information. Each page has a print button, which generates a printer-friendly version of the page on the screen. Under the function buttons, the section title appears. Basically, the section title tells the users on which event they are. The content field shows the text from the information database of the system which is the guidebook, resources and other related information. Lastly, the system is hosted by a server at Indiana University and credit is given to the university at the bottom of each page. The footer bar also contains links regarding to privacy, copyright, site map and contact information.

Content and Tools Related Components The Internet-based Systemic Change EPSS has 6 main components:

1. Providing guidance to the facilitators*:* This component is the kernel of the system and is event based. It provides a facilitator with the big picture of currently shown event in the system, which contains the important issues about the event. It gives a general view to the users about the activities that are going to take place, the place of the event in the whole process and the points that need particular attention. Additionally, the user is able to access to the other parts of the system from this component.

2. Electronic version of the systemic change guidebook*:* The guidebook is designed in a hierarchical structure as, from general to specific, phases, events and activities. The book has 6 phases, each of which contains a number of events, and each event has variety number of activities. This component is an organized way of presenting the knowledge of the book conveniently and providing easy accessibility to the book.

3. Resources*:* This component of the site contains the resources that develop the skills and knowledge of facilitators about educational systemic change process. These resources are categorized as readings, videos, case studies, sample documents and software tools. The site coordinator maintains these resources and updates them as required. Facilitators currently do not have permission to upload any resources to this component.

4. Community*:* The purpose of community component is to bring people involved in systemic change activities, especially facilitators, in one accessible place. The community component enables users of the system to share their experiences, concerns, questions, resources, and documents related to their systemic change efforts. The main feature of community component is online threaded discussion groups. The discussion software can be adjusted according to the topics' and users' needs. The technology behind the threaded discussion group software includes JavaScript, PHP (hypertext preprocessor language) and MySQL database. Also the system has a directory of people who are facilitating different systemic change projects in order to introduce the members to each other.

The component also provides school districts with a knowledge base to find a facilitator who has experience with similar contexts.

5. Glossary*:* This component provides a brief summary of the process of systemic change and related key concepts and terms about it. It has two purposes, first it provides a common language for the terms and concepts used in the change process, and second, it provides information about a brief summary of the systemic change effort, which is an article written by Jenlink et al. (1996).

6. Frequently asked questions (FAQs)*:* This component provides archived answers to questions frequently asked. The answers are provided by experts in the field. The content is fed by discussions and e-mail messages.

Tutorial Component In order to help people to use the system most effectively and efficiently in terms of time wise and learning curve, the system provides an introductory 'how to use the system' manual. This section serves for two purposes: first, it is a real user's manual on how to use the system and second, it is one of the diffusion of innovation tactics.

At first glance, it may seem that the use of the system is easy and one can figure out the ways to use it. It is true that the use of the system is easy and its interface is intuitive, however in order to use it at the most efficient level, one needs to know some key functions of it.

Despite the fact that computers and the Internet are ubiquitous in our everyday life, some people may not feel comfortable to use them because they do not receive enough guidance on how to use those systems. The manual serves as an ice-breaker for this kind of people.

Benefits of the System

The Internet-based EPSS for systemic change facilitators provides more information and tools to its users than a static website. One benefit of the system is to provide guidelines for each event of the change process. The consultation component of the system contains all information related to the events that the facilitators need to perform to achieve certain stages of the change process. Another aspect is that the EPSS has community building tools, such as threaded discussion groups and a members' directory. These tools add value to the EPSS and give power to the users to reach each other easily and to share their knowledge. Additionally, through gathering the knowledge from facilitators who use the website, it provides an invaluable knowledge base for further implementations of systemic change efforts in different school districts.

Another benefit of the system is its low maintenance and update costs relative to printed or optic media since the system is using online technology to disseminate the information via the Internet. The technology powering the system allows the administrators to maintain and update the site without much software knowledge and programming skills. The infrastructure of the system uses DHTML, JavaScripting and basic HTML, thus it does not require downloading high-end browser plug-ins such as Flash player or Shockwave, which allows users to connect the system with even very low bandwidth connections technologies, such as Bluetooth or cellular phone.

Conclusion

An EPSS is a system that provides cognitive support to a performer at the need of complex and accurate information. Educational systemic change is a complex and difficult process which needs certain stages to be accurately implemented. The developed EPSS aims to provide knowledge, guidance and necessary tools for systemic change facilitators in the change process. Specifically, the system provides guidance on change process, an electronic version of the guidebook, community building tools, glossary and frequently asked questions. A tutorial about how to use the system is added to increase the effectiveness of the system.

The system leverages the function of the systemic change guidebook. Because the delivery method of the system is the Internet, it can be reached anywhere in the world by any facilitator. Since most of the administrative components are accessible through the Internet, the system can be maintained at a low cost and accessible at anytime and anywhere. The EPSS helps with the accumulation of knowledge contributed by experts in the field. Because of all these contributions, we perceive the EPSS as a feasible solution to similar projects, which require use of massive knowledge and precise performance.

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Assessing Technology Integration in a New Teacher Education Program

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The Education program at Okanagan University College (OUC) began in 1989 in partnership with the University of Victoria (UVIC), a larger institution with a long tradition of teacher education in the province of British Columbia. In this partnership arrangement students took the University of Victoria education program at the OUC campus in Kelowna and were taught by OUC Education faculty. Upon graduation students received their B.Ed. degrees from the University of Victoria. This partnership was to remain in place until OUC could begin offering its own independent degree. For this to occur OUC needed to design a completely new education program. Faculty and administration worked together to complete this task and in September 2002 the new OUC Bachelor of Education K-12 program was unveiled and implemented.

The new OUC Education program is designed to guide students toward the best ways to engage in professional practice in a pluralistic post-modern context. The program is based upon the following foundations: constructivism, de-centered practice, experience and knowledge as interpreted phenomena, collaborative approaches to teaching and learning, reflective practice, and an emphasis upon information technology. The latter foundation was emphasized so that graduates of the program would have greater experiences and advanced skills at technological use. As these new teachers entered the profession, they would, thus, be able to integrate technology more effectively into their own classrooms. A theoretical perspective that was key to the development of this aspect of the program was the acknowledgement of the non-neutral nature of technology. Information technology would not simply be "plugged-in" to this new program as a discrete course of study, or tagged onto the margins of the curriculum or timetable; instead, information technology would be regarded as a prominent feature of the curriculum, inherent in the overall design of the program. It was determined that information technology would be integrated, available, and accessible in as many parts of the program as was feasible including practicum seminars and field experiences.

A formative assessment undertaken during the developmental stages of this new program determined the resources and facilities required to establish a strong program foundation in information technology. The assessment was based upon the essential conditions for the general preparation of teachers established as part of the National Educational Technology Standards. These essential conditions are: a shared vision, access, skilled educators, professional development, technical assistance, content standards and curriculum resources, student-centered teaching, assessment, community support and support policies (I.S.T.E. 2000, p. 6). It is recommended that a combination of these conditions be in place at the university, the college or school of education so that prospective teachers can create learning environments that are conducive to powerful uses of technology (I.S.T.E., 2000, p. 6).

The OUC Education Program Department Chair served as the chief program designer and his field notes, which included observations as well as anecdotal reports from administration, faculty, and technical support staff served as an estimation of the level of essential conditions that would be present at Okanagan University College at the time the new program would be implemented. These data provided a description of the existing presence and strengths of each essential condition for general teacher preparation. Through this assessment it became apparent that a number of the essential conditions existed at the Okanagan University College prior to the development of the program; however, it was found that other conditions were not present at all, or if they were present, required much stronger support and resource allocation to ensure that the program would operate successfully. The findings enabled administration and faculty to address particular essential conditions and strengthen those that were deemed to be weak. It was realized that the implementation of information technology in this program required both increased resource allocation and increased professional development. These increases would ensure that the essential conditions would be in place as the new program was launched and would remain in place so that the new program could continue successfully.

Each of the ten essential conditions is discussed below with reference to the field observations and the actions undertaken to address the conditions that required improvement. The discussion of the actions taken in response to the assessment is significant in that it describes the technological requirements; support services; professional development; instructional strategies; and administrative responsibilities, initiatives, and directives necessary to enhance student teachers' technological literacy in a new teacher education program. The results of the assessment are pertinent to those involved in program/curriculum design, instructional design, educational technology and will also be of interest to teachers, teacher educators, technology support staff and program administrators.

1. A Shared Vision The professional education administration and faculty share a vision for technology use to support new modes of teaching and learning (I.S.T.E., 2000, p. 6).

Field Observations:

Most instructors do not use technology in their teaching. The few that are using technology do not necessarily acknowledge its importance beyond that of a tool. When information technology is used it is primarily used to enhance traditional teaching methods. There is little evidence of technology transforming instruction into new modes of teaching and learning.

The existing (UVIC) program is exclusively elementary with methods courses in nine different areas. Instructors generally follow and expect a strict adherence to discrete study of subjects and consequently little or no integration of these courses occurs. Several instructors regard time spent integrating technology as time away from their discipline. Most regard technology an external element to teaching and to their subject area specialization.

A very conservative atmosphere exists in the program. A portion of the faculty want to remain in the partnership association, i.e. not change the program at all!

Actions:

OUC's new program emphasizes instructional themes such as "Developing Instructional Strategies," "The Culture of the Classroom," and "Integrating, Assessing and Reporting." These themes are taught in modules by "teams" of instructors. Short seminars in the subject specializations are also included in each module. The emphasis upon instructional themes and teams rather than individuals teaching only their specialized discipline area as a single course has helped break faculty of out a discrete approach to subjects and has moved faculty as a whole toward a more integrative approach to learning. Still, the acknowledgement of information technology within instruction remains problematic, particularly when a faculty member sees funding spent on information technology and not spent on resources for their specific subject specialization.

2. Access Access to current technologies, software and telecommunications networks is provided for teacher education faculty, classes, and field sites, including technology-enhanced classrooms that model environments for facilitating a variety of collaborative learning strategies (I.S.T.E., 2000, p. 6).

Field Observations:

A well-endowed Educational Technology Center exists; however, most faculty members have little to do with it since it is used for instruction in discrete courses (i.e. The Computer in the Classroom). Students use the Center extensively for Web browsing, word-processing and printing.

All instructors have computers in their offices but they are old computers networked only for printing. Instructors have ports in their offices to access the Web, but their computers cannot run Web-browsing software. Some classrooms have Web access but instructors' computers are not powerful enough to make use of these ports.

Internal faculty communication is through paper, almost exclusively.
Even though many students have home e-mail accounts, as do most instructors, computers are used very little for communication in field experiences.

Actions:

Over the year leading up to the new program implementation (2001), all faculty members received new laptop computers and computer projectors were installed in all classrooms to take advantage of the Web ports that existed in these spaces. Now, all internal faculty communications (announcements and minutes of meetings) are done with e-mail and attached documents. WebCT has been implemented for classroom administration and several instructors make extensive use of this teaching support tool by posting learning resources and learning objects online. The faculty is planning to implement a ubiquitous computing initiative this year (a wireless zone in the faculty building). Access to field sites remains problematic; however, several instructors are beginning to use WebCT for communication with practicum students and sponsor teachers. Additionally, the faculty is experimenting with a new video-conferencing system that may prove very useful in communicating with sponsor teachers and supervisors in our college centres and in field sites. As instructors become more adept at using Web-based resources for teaching and become accustomed to electronic conferencing, the problem of access for faculty and students may be resolved, perhaps quite soon.

3. Skilled Educators Teacher education faculty are skilled in using technology systems and software appropriate to their subject area specialty and model effective use as part of the coursework (I.S.T.E., 2000, p. 6).

Field Observations:
Instructors generally possess basic computer skills: word processing, e-mail, and use grading packages, but generally do not use information technology as part of their classroom teaching. This is primarily due to a lack of facilities and resources rather than a lack of skills.
Although provincial curricula recommend technological use in all subjects taught, this is not significantly modeled in classroom instruction. Again this may be due, primarily, to a lack of facilities and appropriate software.

Actions:
Over the last two years as the new program was being developed and implemented instructors have been provided with professional development workshops (in addition to new laptops). This scenario, in combination with the installation of computer projectors in all classrooms and the availability of WebCT, has permitted many instructors to use Web resources in class as part of their teaching. Because of these resource additions there has been a noticeable change in the use of information technology in classroom practice. Generally, instructors' skills in using information technology are improving.

4. Professional Development Personnel in teacher education and field experience sites are provided with ongoing professional development (I.S.T.E., 2000, p. 6).

Field Observations:

- OUC's computer services department provides some professional development workshops, however, these generally are application type of workshops (how to use Microsoft Word, or PowerPoint). They are not specific to the use of software packages in teaching or in the manner in which technology, generally, can be used to transform teaching practice.
- Many of the students enter the program with advanced skills in information technology, in some case more so than that of their instructors.
- There does not appear to be much time for professional development opportunities. Instructors are very busy teaching and supervising student teachers.

Actions:
Funding levels have been increased to provide professional development workshops during the summer months for Education faculty. Most recently (July 2003), David Moursund, who is well known for the many editorials and articles he has written for *Learning and Leading with Technology,* came to OUC and presented several workshops on problem solving and project-based learning. These workshops were very successful and provided instructors with resources and models to use technology to transform their teaching practice.

5. Technical Assistance Technical assistance for teacher education faculty and students is readily accessible and includes expertise in the use of technology resources for teaching and learning in PK-12 setting (I.S.T.E., 2000, p. 6)
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Field Observations:
The program has on staff a lab facilitator who is available to solve computer and general media problems for both faculty and students.
The computer services department provides the general maintenance of faculty and lab computers. They are responsive to faculty needs and trouble-shooting is done efficiently.

Actions:

The OUC program is very fortunate to have on staff an education lab facilitator/technician who is available to solve both faculty and student problems. Although this individual did not begin the position with specialized knowledge in educational applications of technology, experience gained from years of trouble-shooting and problem solving resulted in a very skilled individual who makes an valuable contribution to the technology aspects of our program. The presence of this individual in our program exemplifies the benefits of having technical assistance and support from an educational specialist.

One important addition to the University College staff was a campus technological coordinator who has a very strong background in pedagogy (he was an elementary school teacher for 13 years). He has spent a great deal of time with Education instructors teaching them to use PowerPoint, develop Web pages and use WebCT to enhance their classroom practice. Instructors have responded very positively, likely because this individual knows what is needed, and is keenly aware of what can be accomplished is a given amount of time. He is adept at providing people with the right amount of information: enough so that they can use information technology effectively, but not so much that they become overwhelmed. Although he was hired to work with all faculty areas at OUC his presence has greatly benefited Education faculty and students. He initiated a highly subscribed and very successful “Student Teacher Technology Leadership Program” that prepares education students to provide professional development in information technology for teachers in the local school districts.

6. Content Standards and Curriculum Resources Technology-based curriculum resources that address subject matter content standards and support teaching, learning and productivity are available to teacher candidates (I.S.T.E., 2000, p. 6).

Field Observations:

Provincial curriculum guides (integrated resource packages) are available as PDF files on the Web, most instructors, however, require that students purchase paper versions.

Little software is available that is curriculum specific.

Instructors will order curriculum resources (Lab packs of CDs: tutorials, education games, and simulations) but often not use them.

Actions:

Good content specific software for teacher educators remains difficult to find. Education faculty members are increasingly relying on Web resources in the form of Webquests and instructional objects to serve as teaching resources. The professional development workshops in using WebCT and in applying learning objects to teaching have increased instructors’ interest.

7. Student-Centered Teaching Teacher education faculty and professional teaching staff model student-centered approaches to instruction in education coursework and field experiences (I.S.T.E., 2000, p. 6).

Field Observations:

Instructors tend to teach the way they were taught—teacher-centered instruction is the prime teaching method.
There appears to be resistance to student-centered teaching—from both instructors and students.
Some instructors claim that the specific nature of their subject specialization requires a teacher-centered approach.

Actions:

Increased comfort with providing students with more “agency” over their learning may come with further professional development. Presently, teacher-centered instruction remains the primary mode of teaching. However, the new program has a four-credit capstone exercise, the Guided Reflective Inquiry Project (GRIP). This exercise permits students to undertake an inquiry of the own choosing and present their findings to faculty and peers in a public forum. This project-based learning assignment conforms to many of the objectives outlined by Moursund (1999). It is decidedly student-centered and may serve to model the benefits of this method of learning for both instructors and students.

8. Assessment Teacher education faculty and professional teaching staff model the integration of teaching and assessment to measure the effectiveness of technology-supported teaching strategies (I.S.T.E., 2000, p. 6).

Field Observations:
Technology-supported teaching strategies are not all that evident in the program. There is not much to evaluate.

Actions:
The new OUC program has established an educational advising council comprised of external faculty and community stakeholders to provide formative evaluation of our program as it is developed. We are planning an external summative evaluation of our program once the new design is completely implemented. The success of any new technology-supported teaching strategies will be accounted for in this assessment. In addition to these evaluation processes, our program must be assessed and approved by the provincial accrediting body, the *British Columbia College of Teachers*.

9. Community Support Teacher preparation programs provide teacher candidates with opportunities to participate in field experiences at partner schools where technology integration is modeled (I.S.T.E., 2000, p. 6).

Field Observations:
The Education program has an official partnership with a local community elementary school. However, there is little time available to plan and implement truly innovative activities through this arrangement.

The Education program and student teachers receive strong support from the local school districts for student teacher placements; however, the integrative use of information technology is not generally modeled in most local schools.

Actions:
Time seems to be the major impediment to integrating activities between OUC and local schools. The most recent and positive step in this direction has been the "Student Teacher Technology Leadership Program" initiated by OUC's Educational Technology Coordinator. This program prepares education students to provide professional development in information technology for teachers in the local school districts. It provides OUC education students with opportunities to teach technology while at the same time provides professional upgrading to

10. Support Policies Policies associated with accreditation, standards, budget allocations, and personnel decisions in teacher education programs and field experience sites support technology integration. Retention, tenure, promotion, and merit policies reward innovative uses of technology by faculty with their students (I.S.T.E., 2000, p. 6).

Field Observations:

There is little technology integration presently occurring.

Actions:
It is unlikely that tenure, promotion, and merit will be tied directly to instructors' technological use. However, tenure, promotion, and merit are connected to grants and funding and these are available for technological applications. Consequently, there is a connection between tenure, promotion, and merit although not a direct connection and certainly not one that is an established policy. Ultimately, teacher educators can find funding sources and research avenues in the areas of technology. Participating in technological innovation can yield substantial benefits in funding and can, indirectly, result in tenure, promotion, and merit.

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Triggering in-depth argumentation through scaffolding tools

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Abstract

This paper explores how argumentation procedures could be triggered by Knowledge Forum scaffolding tools in the context of a community of practice of nurses in the domain of health. We present a brief historical context of the constitution of this community of practice, describe the participatory design process, explain how communication was scaffolded by instances of arguments through use of the tool, and how community interaction was managed to enable a knowledge-building process sustained by conversational practices organized around arguments. In addition, we describe the discourse analysis method used to study the scaffolding of the collaborative argumentation process. Results suggest that high level of intentional use of the scaffolding tool, which might be related to previous research identifying a higher order level of ill-defined problem-solving and collaborative learning, are characteristic of knowledge building processes (Campos & Laferrière, 2002; Campos, in press).

Objective

The research aims to verify that a community structures collaborative knowledge through the use of a scaffolding tool, leading to a higher level of ill-defined problem-solving. Results suggest that the scaffolding tool assists problem-solvers to communicate in a structured way by applying the appropriate steps necessary to sustain an idea and to convince others of its importance, relevance and / or plausibility. The value of integrating online conferencing, be in totally online or mixed-mode contexts, has been widely recognized but, to our knowledge, there are no studies focusing on knowledge building scaffolding tools. This research aims to provide quantitative and qualitative evidence of the pertinence, adequacy and ability of conferencing systems, in particular Knowledge Forum, for the triggering of in-depth thinking and higher order collaborative learning. Studies point to the fact that (1) community management is necessary but not sufficient to support knowledge building, and that sufficiency might be achieved by the use of proper tools (Campos, 1998). In addition, cognitive research on reading and writing processes has shown that (2) the availability of databases and the possibility to revisit and work on saved "memories" enables conference participants to keep track of networked conversations and to build communities of knowledge (Scardamalia and Bereiter, 1994). We will present how the nurses of a pan Canadian community working on problems of their practices used the Knowledge Forum scaffolding tool and how it supported the structuring of their progressive communication process. The scaffolding tool was customized to support argumentation by helping the facilitator (1) and by enhancing the nurses' reading and writing processes (2).

Theoretical Framework

When people participate in electronic conferences, they have written conversations. Paradoxically, those conversations neither have the formal structure of essay writing nor the informal character of personal conversations. However, although scarce, the literature has highlighted the fact that a conversation "in writing" allows the participants to reflect more consistently about their ideas because of the editing process that is involved in active reading and writing (Bruer, 1994, Scardamalia & Bereiter, 1994). This reflexive way of participation can induce networked partners to engage in collaborative learning and knowledge building. How? Piaget explained the process of awareness as the engine of change that scaffold new paths of understanding (1974). There is a clear difference between being able *to succeed* when performing an action and *to understand* it. This finding followed research to verify the difference between succeeding and understanding in the context of physical actions (children's playing games, for example). The analogy is applicable to studies concerning discourse: a person can *succeed* in identifying a problem and structure it through language but *to understand* the problem, to lay down an argument, to identify the premises and to reflect upon them, and to solve the problem by putting forward an acceptable solution to the argument, requires logical reasoning (hypotheses formulation).

The distinction between *succeeding* and *understanding*, points to the difference between *cognitive* and *meta-cognitive* behaviour, largely investigated by cognitive science in general and cognitive psychology in particular. Meta-cognition is an awareness of our own cognitive processes, or a vigilant state in which we are able to be aware of the necessary steps to transform a concept, a notion or an idea. The *change* from previously held concepts, notions or ideas to new ones (or transformed ones) might follow the scientific method (drawing conclusions from data and arguing for the validity of the concept) or “popular” or “naïve” methods (drawing conclusions believed to be true by the individual for reasons that are psychological). Conceptual change is, thus, an intentional and reflective cognitive process leading to higher order learning (be dealing with scientific concepts or psychological notions and ideas) as opposed to lower order learning which is mainly automatic and most of times genetically determined. When the networked conversation process is collaborative, concepts, notions or ideas are changed or transformed in a collective exchange, as is the case of network-enabled asynchronous written discourse processes.

The understanding that scaffolds are important in education has been discussed since Bruner (1985). However, we have no knowledge of research on enabling argumentation in collaboration through the use of technologically embedded scaffolds. I hypothesize that scaffolding enables meta-cognitive processes as explained above. Piaget’s model of knowledge proposes that logic expresses abstractly the fundamental operations of the brain and his psychology proposes that meta-cognition is a developmental process of operating logically. Thinking, thus, is governed by procedures that progress along time in an active process of conceptual assimilation and accommodation leading to adaptation to the social environment. This process shapes new paths of understanding through recursive comprehension and interpretation. Because electronic conferencing is distributed, meta-cognitive processes are both individual as social. Salomon (1993) argues that distributed cognition is “social” and “individual” because although cognitions are not distributed and procedural knowledge is totally individual as well as representations, the social nature of language requests both distributed and individual processes. According to Scardamalia (2002), knowledge building is a progressive process of production and improvement of ideas that are important for a given community. Scaffolding tools might be one of the ways to trigger and to improve meta-cognitive processes in electronic conferencing because they require logical reasoning or inferencing drawn from the contributions of others, a distributed context that is individual and social. By using scaffolds, participants of a knowledge building community can build on concepts, notions and ideas that others have structured and “tagged” before.

Social and Technological Context and Research Method

The OIIQ - Order of Nurses of Quebec, in partnership with hospitals of three Canadian provinces and other institutions (CEFRIO, CANARIE, and Fonds de l’autoroute de l’information), formed a French speaking community of nurses with expertise in heart care to address a perceived public concern concerning heart illnesses, the main cause of death among Canadians. I collaborated with the Order of Nurses of Quebec by supervising the facilitation and community building processes, applying a participatory design methodology in a research-action context. Participatory design is mainly understood as a process of developing software with the active collaboration of users. I applied this concept not develop any software but as an intervention method designed to build the community with all those interested in it: the Order of Nurses, the hospitals and health centers, the facilitator, and most of all, the nurses. It is particularly important to state that (1) the Order of Nurses was the institution who launched the idea and negotiated agreements with the hospitals without the intermediation of the researcher, (2) that the facilitator was recruited by the Order of Nurses in a process in which the researcher collaborated actively, and (3) that the nurses recruited by the facilitator voluntarily joined the community. The main goal of the actors of this process was to shape a networked environment in which the nurses could share their scientific and practical expertise on heart care in order to come up with recommendations able to be transferred to the public. The Order of Nurses of Quebec chose the conferencing system (Knowledge Forum) in active consultation with the researcher.

We designed, the facilitator and I, and in consultation with the nurses and the scientific direction of the OIIQ, all necessary steps to build the community. Before launching the community, three different sub-groups of nurses were personally introduced to each other. The first subgroup meeting gathered all nurses living in the Montreal area (province of Quebec) and municipalities located within 2 hours from the city such as Ottawa, in the province of Ontario. The second subgroup meeting gathered all nurses living in and around Québec City. The third subgroup meeting, with nurses living in distant parts of the province of Quebec and New Brunswick, organized them around a telephone conference designed to introduce them to each other and to train them in the use of Knowledge Forum. After this first phase, and to ensure that all nurses were introduced to each other, the facilitator and I designed the KF environment. Many “views” were opened (conferences or forums are called “views” in Knowledge Forum). The first conference called “Welcome” was designed to provide administrative information by the facilitator and to give access to the other conferences. The second conference, “Presentation”, was designed to allow the participants to present themselves with a short biography and photo. A third conference called “Tips” offered tips on how to navigate through KF discovered either by the facilitator or the nurses. The fourth conference, “At the heart of our exchanges”, was the launching conference. Its goal was to identify which problems related to the nurses' practices were most appealing for discussion and most relevant for their professional lives as related to public needs.

In addition to features that are common to many conferencing systems (like key-wording, word search), Knowledge Forum has some others that make it unique such as (1) Editing (users can edit their messages even after they were posted), (2) Annotation (users can annotate messages by inserting "post-its"), (3) Quoting (users can quote texts written by colleagues by simply dragging them inside their messages), and (4) Rise-above (users are able to synthesize messages by packaging them within an upper folder). However, it is the (5) Scaffolding tool that was used in my research to test the hypothesis that structuring discourse was an important factor in the consistent knowledge building and collaborative learning identified in previous studies (Campos & Laferrière 2002, Campos, in press). The KF scaffolding tool allows users to insert tags within the text in order to categorize their own thinking.

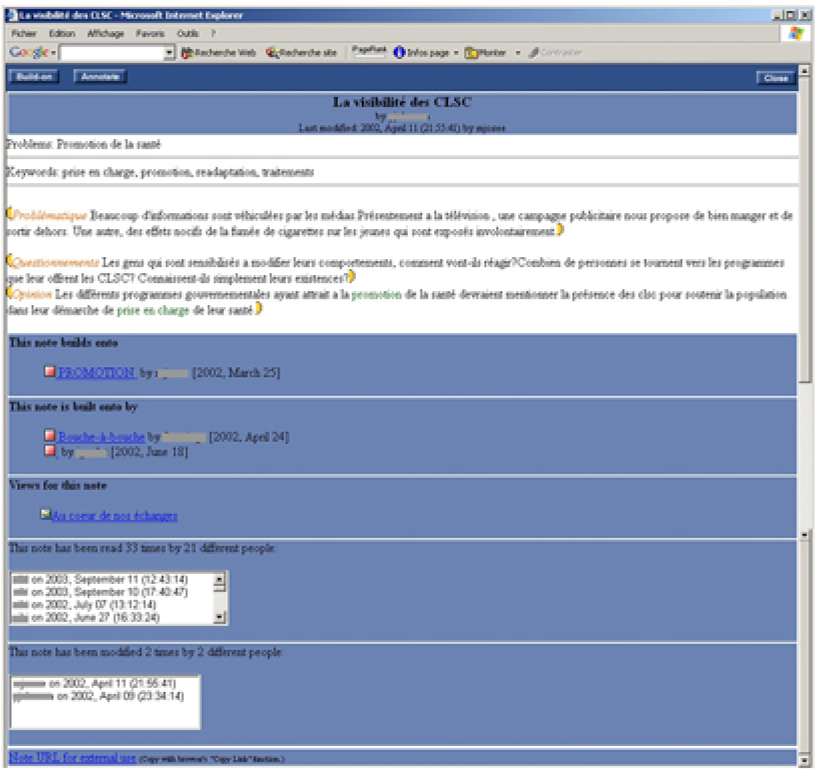

Figure 1. This screen capture shows one message in which the text was structured with the help of scaffolds "Problématique", "Questionnement", and "Opinion" (between the yellow brackets).

In order to enable argumentation procedures to be intentionally organized, I conceptualized scaffolds analogous to some instances of arguments that I have been applying in the coding of conference transcripts (Campos, 1998; 2000; Campos and Laferrière, 2002; Campos, in press). I inspired myself partially on Toulmin but did not follow his procedures because it would be unrealistic to apply a fine-grained analysis conceptualized to study dialogues and texts, for large databases as those found in electronic conferencing. We used some of his instances as scaffolds and created others:

(1) Claim - introduction of a contextual situation that expresses concerns or difficulties concerning the practice or beliefs held by the writer, affirming something

(2) Data: introduction of facts, statistics, scientific data, research results or other works that have an influence on the practice and would support the claim, or else psychological reasons for the standing of an idea.;

(3) Envisaged solutions: engaging in a process of hypothesis formulation that might provide an answer to the claim put forward and consistent with the data

(4) Questioning: formulation of interrogations

(5) Opinions: offering judgments concerning claims, data, questioning or envisaged solutions presented in a previous message as a way of introducing a new turn of argumentation, unrelated to the other scaffolds.

My goal was to enable the participants to anticipate what their arguments would be, recognize their structures, and apply the instances of arguments intentionally and meta-cognitively within their collaborative conversation without affecting spontaneity. I recognize that those scaffolds might be insufficient or incoherent if used in some discourse contexts, but the idea was that of "keeping it simple" and providing the nurses a minimal structure for their collaborative exchanges.

Results

Data

The entire database consists of 545 messages and approximately the same number of annotations. For the purpose of this study, we chose to study two conferences: one in which problems related to heart care practices were identified (with 122 messages), and another one in which nurses worked together to prepare deliverables to address the problems identified (with 141 messages). In the first conference nurses explored the difficulties of engaging patients in the prevention of heart failure by encouraging them to share the responsibility for their treatment, and by participating in the development of nursing strategies that could help their condition. In the second conference, the nurses prepared a teaching instrument to be handed to patients to help them control symptoms and signs of heart failure and therefore to enable auto-surveillance. The criteria to choose these two conferences were (1) the fact that nurses discussed what they considered to be important issues in heart care in the first conference, which was the start-up discussion, and (2) that the issues identified in the first conference were discussed more in depth in the second. It was in this second conference that a heart care kit was conceptualized and produced in order to be broadcast through the website of the Order of Nurses of Quebec to help the public to take charge of their own heart health. It is important to note that there is continuity between the first and the second conference. I limited the number of conferences to be studied (there were nine conferences) due to the extent and complexity of dealing with a large database. In addition, given that those two conferences were the core of the nurses' activities, I considered that they were enough to identify the way that nurses engaged in the use of scaffolds.

The unit of analysis

I worked with two analytical unit levels: a technological one (the message) and a meaning one (the sentence). To study the sentences, two coders broke up the message texts, and then met to discuss minor differences found in order to achieve consistency. I adopted the *sentence* as the human cognitive unit of analysis because every meaning system reflects an action (which can be physical or discursive) that has a subjacent logic that emerges within the appropriate context. Piaget explains that *action schemes* are the products of assimilation processes in which previous procedures related to sequences of movements are applied to new situations while *assimilation* is the process in which new or old objects are incorporated to known schemes (1959). From the language viewpoint, an analogy applies: *Judgments* are acts that put concepts together or apply them to objects. *Concepts* are systematic unities in which extension (logical) defines the class and in which comprehension consists of properties or relations, a predicate being itself a relation. In other words, the meaning unit is not a concept but the *judgment*. In terms of discourse, the minimal unit reflecting a judgment (which contains, necessarily, a verb) is the *sentence*. A *sentence* is "a word, clause, or phrase or a group of clauses or phrases forming a syntactic unit which expresses an assertion, a question, a command, a wish, an exclamation, or the performance of an action that in writing usually begins with a capital letter and concludes with appropriate end punctuation". We add to this definition that the presence of a verb is essential and that sentences express judgments that are not only conceptual (scientific knowledge) but also notional (popular knowledge).

General Statistics

(a) Messages with and without scaffolds

Messages First Conference	Number	Percentage
With scaffolds	90	73.8
Without scaffolds	32	26.2
Sub-total	122	100
Messages Second Conference	Number	Percentage
With scaffolds	95	67.4
Without scaffolds	46	32.6
Sub-total	141	100
Total	263	

(b) Sentences within and outside scaffolds (all messages)

Sentences First Conference	Number	Percentage
Within scaffolds	706	69.9
Outside scaffolds	304	30.1
Sub-total	1010	100
Sentences Second Conference	Number	Percentage
Within scaffolds	741	43.5
Outside scaffolds	962	56.5
Sub-total	1703	100
Total	2713	

(c) Sentences within and outside scaffolds (only messages with scaffolds)

Sentences First Conference	Number	Percentage
Within scaffolds	706	92.0
Outside scaffolds	62	8.0
Sub-total	768	100
Sentences Second Conference	Number	Percentage
Within scaffolds	741	70.8
Outside scaffolds	305	29.2
Sub-total	1406	100
Total	2174	

(d) Occurrences of scaffolds

Scaffold type	Conference			
	First conference		Second conference	
	Number	Percentage	Number	Percentage
Claim	30	13.5	20	10,8
Data	51	23.0	73	39,5
Questioning	60	27.0	33	17,8
Envisaged solutions	54	24.3	28	15,1
Opinions	27	12.2	31	16,8
Total	222	100	185	100

(e) Stand alone occurrences and co-occurrences of scaffolds

Messages with	Conference			
	First conference		Second conference	
	Number	Percentage	Number	Percentage
1 scaffold	37	42.0	63	68.5
2 scaffolds	25	28.4	15	16.3
3 scaffolds	16	18.2	12	13.0
4 scaffolds	7	8.0	2	2.2
5 scaffolds	3	3.4	0	0
Total	88	100	92	100

(f) Occurrence of pairs of scaffolds

	Claim		Data		Questioning		Envisaged solutions		Opinions	
	Conf 1	Conf 2	Conf 1	Conf 2	Conf 1	Conf 2	Conf 1	Conf 2	Conf 1	Conf 2
Claim			8	5	19	5	9	10	10	7
Data					16	5	11	5	23	8
Questioning							13	6	20	7
Envisaged solutions									10	8
Opinions										

Examples of scaffold use

Message written by the facilitator:

Claim The problem concerning the patient decision to take charge of his/her health is related to the non the patient becomes responsible for his/her own health.

Envisaged solutions The solutions envisaged here refer to the importance of considering the needs of each patient and that of following his/her level of adaptation to the illness in order to enable the nurses to guide him/her in the process of taking charge of his/her health.

Questioning What are the nursing strategies that should be specifically designed to follow the patients in their process of taking charge of their health in order to help them change behaviours damaging to their health? What are the models of behaviour change that could guide our discussion?

Message written by one participating nurse:

Claim With psychiatric patients there are contracts made to enable them to take charge of their health and made them responsible for the follow-up. We have one contract concerning aid, another one concerning what has to be done to act effectively… Because they engage in the process of taking charge, most contracts are respected.

Envisaged solutions A contract with cardiac patients is a solution to be considered.

Discussion

What can be achieved by the use of scaffolds? In the examples presented above, it is possible to verify that a process of conceptual change takes place. The facilitator structures his/her message presenting a "claim" (it is needed that patients take charge of their health), "envisaged solutions" (reference to previous suggestions already made), and "questioning" the participants to propose solutions to the problem. One of the nurses, under the scaffold "claim" asserts that with psychiatric patients at his/her workplace, contracts are being used. The envisaged solution (a hypothesis) is that this procedure could be analogically

Although the total number of messages of the first conference is 90, and of the second is 95, stand alone occurrences and co-occurences do not match those numbers. Collaborative conceptual change can be identified here because the hypothetical collaborative process of networked argumentation enables the nurse to jump to another path of understanding and to propose a solution to the ill-defined problem at stake. In this nursing networked community, conference participants "built on" the contribution of others using explicit or implicit conditionals (IF we apply a technique to psychiatric patients THEN this could be a solution for patients with heart problems). In addition, those structures, when under scaffolds, can be clearly identified, as the case of inferencing and implicit hypothesis formulation of the example above shows. The result of this exchange is that participants re-assess and reflect on knowledge, and re-build previously held concepts, notions or ideas. When collaborative conceptual change occurs, then collaborative learning is very likely to take place too. After assessing a process of conceptual change through the identification of the subjacent conditional operations that make people change previously held knowledge (re-equilibrating, thus, meanings that guide understanding), collaborative learning can also be assessed. However, collaborative learning can only be achieved if there is evidence in the sequence of exchanges that conceptual change was definitely incorporated in the renewed discourse, either by affirming it or by re-transforming it in the direction of renewed concepts, notions or ideas. However, a change in concepts, notions and ideas through networked argumentation that become more or less established (stable) in the discourse (thus, collaborative learning) is not evidence of knowledge building. The change has to be profound, i.e. the resulting knowledge must be unique and a truly collective result of many asynchronously interconnected minds, something that an individual could not achieve alone. Although the occurrence of conceptual change, collaborative learning and knowledge building, which indeed happened, is not the focus of this study (verification is presented in previous studies: Campos & Laferrière, 2002, Campos, in press), the role of the scaffolds is. The question here is to understand whether scaffolds had an impact in the way the nurses participated and collaborated.

No proof can be presented that the scaffolding tool effectively triggered more profound discussions. One could argue that discussion could be profound in the absence of scaffolds, and only an experimental design applying rigorous methodologies such as think aloud protocols could offer definite evidence of a possible active role of scaffolds in triggering conceptual change, collaborative learning, and knowledge building. However, such a design would be inapplicable in a context of participatory design research, would certainly impeach spontaneity, and arguably freeze interactions. I participated in and followed the whole process of this community, which was active during six months. As explained above (section "Data"), the first conference studied here was one in which the nurses explored the problems of educating patients and helping them to take charge of their health. It was a kind of brainstorming process in which they explored dozens of issues related to this subject in the search of the most appropriate deliverable. I would label this conference as being in a *reflective mode*. The examples presented above were taken from the first conference. As a result of discussions done in this conference, the nurses decided to build a heart health kit, which was fully developed in the second conference. The heart kit produced by the nursing networked community (http://www.oiiq.org/santecoeur/) was published on the website of the Order of Nurses of Quebec (http://www.infirmiere.net/nouveau_infvir/contenu/sante_coeur/index.htm). I would label this conference as being in a *production mode*. In addition to have resulted in a concrete object of knowledge, shared through the web, the reading of the database messages strongly suggests that the scaffolds had a positive role in the way nurses structured their thoughts. The fact that they had to think about what they have to say and structure instances of their arguments within scaffolds shows, at least, that: (1) scaffolds were *intentionally* used to organize the content of the nurses contributions (*judgments*), and (2) that intentional processes of this kind were necessarily meta-cognitive because it was very unlikely for the nurses to organize collaboratively the content of communication this way while being naïve and unaware of his/her own thinking processes at the same time.

Quantitative results, although merely indicative, support these claims. First, around three quarters of all messages written in the first conference and a third in the second presented scaffold use (at least one scaffold), as shown in Table (a). The difference between the conferences is understandable because, in the first one, problems were being actively explored and solutions actively searched, while in the second the nurses were in a *production mode*, i.e. writing down the content of the tool kit. This context explains why sentences within and outside scaffolds (all messages) followed a similar trend in the first conference but not in the second, as presented in Table (b). However, if only messages with scaffolds are analyzed, then a much higher level of sentence inclusion within scaffolds is found: 92% in the first conference, 70.8% in the second conference (Table c). These numbers show a consistent scaffold use, suggesting that nurses intentionally structured their thoughts in a meta-cognitive way. It is certain, though, that the use of scaffolds had a different pattern in the second conference as Table (f) on patterns of scaffold combination shows. However, not much can be said of this pattern without further studies because the scaffold "opinion" is misleading and could be presented as a "claim", "data" or an "envisaged solution". In addition, it is interesting to note the mechanics of scaffold use. First of all, in the first conference the nurses used to combine scaffolds in the messages: if all co-occurrences are combined the result is 58%. This trend is different in the second conference: if all co-occurrences are combined the result is 31.5%. Conversely, inserting just one scaffold was more frequent in the first conference (42%) than in the second. In this conference, scaffolds that occurred alone and hence were not combined with other scaffolds, responded for 68.5% of the occurrences, as shown in Table (e). It is interesting to note that the scaffold "opinion" occurred more frequently when alone. In the first conference, it was responsible for 54.1% of stand alone scaffolds, and in the second, 20.6%. As mentioned above, different from the other scaffolds, which are really instances of argumentation ("claim", "data", "envisaged solutions" and "questions"), "opinions" were sometimes "claims", sometimes "data" presentation, and sometimes "envisaged solutions". It is plausible to think that in some circumstances, it was "easier" to structure thoughts within a scaffold such as "opinion". However, the negotiation process of establishing meanings to the scaffolds to be used, it had been suggested that the scaffold "opinion" would be pertinent for *answers* in which nurses would comment on the contributions of colleagues. If analyzed this way, the use of this scaffold shows a higher level of responsiveness in the community, especially in the first conference (*reflective mode*). It is understandable that its use fell in the second because "opinions" were less pertinent in a *production mode* in which only validated data related to the effective production of scientific content based on practice could be incorporated to the health tool kit.

Last, but not least, the numbers concerning the occurrence of scaffold types shown in Table (d) confirm the nature of the different modes related to each conference, and provide indicators of the meta-cognitive character of a great deal of interactions within this community. The basic elements of an argument (not doing a fine-grain time-consuming analysis) are: “claim”, “data”, “envisaged solutions” (warrant) and “questioning”. A person affirms something (“claim”) and, to defend his/her point of view, needs to present “data” to support the claim. Claims can be in turn disputed through “questions” that lead to hypotheses that are formulated as “envisaged (possible) solutions”. This sequence is not mandatory and variety is the rule in networked informal conversation, which is discourse far from the juridical framework which inspired Toulmin (1958). “Opinions” entered as a recursive movement that could be confounded with any of the previous instances of argumentation. The numbers are eloquent. In the first conference, they are reasonably balanced. However, it must be noted that the pair “questioning / envisaged solutions” are responsible for 51.3% of all scaffolds indicating a very high level of inquiry and hypothetical reasoning, strongly suggesting the plausibility of the *reflective mode*. Although the pair does not co-occur necessarily, as Table (f) shows, each of its scaffolds operates significantly with the other scaffolds. In the second conference, this trend changes significantly. Reflective thinking suggested by the use of the scaffolds “questioning / envisaged solutions” is still high but the scaffold “data” is responsible alone for 39.5%, which is in line with a *production mode* in content (data) for the heart health kit is what is really at stake.

Conclusion

Results show that the nurses involved in the heart health networked community supported one another in the knowledge building process and used the scaffolds consistently to structure their arguments. Most conference messages show the use of at least one of the scaffolds created to help participants to structure their thoughts through instances of argumentation. This fact, combined with all other aspects explored in the discussion, suggest that the hypothesis that scaffolds representing instances of argumentation had a significant role in the collaborative knowledge-building process of the community of nurses: they made claims, presented data to support them, questioned, hypothesized and proposed concrete solutions to the problems discussed. Many other aspects are still to be studied concerning the use of Knowledge Forum scaffolding tools in this community and others. However, this brief and introductory study suggests that this tool, customized with argumentation instances discussed in collaboration in a participatory design process, is worth using, enhancing and ameliorating.

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KC REACHE: A "Brick & Click" Model of Shared Student Services

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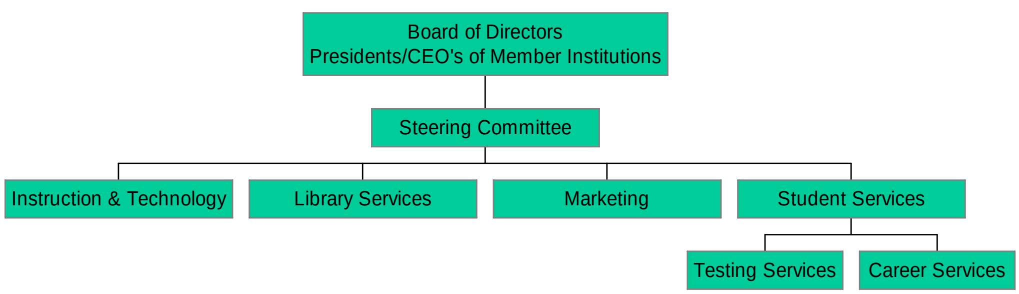
Introduction

The Kansas City Regional Access Consortium for Higher Education (KC REACHE) is an alliance between Kansas City Public Television (KCPT-19) and nine colleges and universities in the greater Kansas City area that have pooled their resources and expertise to offer distance learning options to area students. KC REACHE is a unique alliance in that it includes two-year colleges as well as four-year, public colleges as well as private, large as well as small, Kansas institutions as well as Missouri institutions. KCPT, which serves both Kansas and Missouri around the greater Kansas City metropolitan area, is the coordinating and fiscal agent for the consortium. The nine member colleges include Avila University, Johnson County Community College, Kansas City Kansas Community College, Metropolitan Community Colleges, Missouri Western State College, Northwest Missouri State University, Park University, University of Missouri-Kansas City, and Washburn University.

KC REACHE began as telecourse buying consortium in 1997. KCPT's original role was to license the telecourses. As it became clear that the future of distance learning was online, KC REACHE redefined itself more broadly as a distance learning consortium and formalized its structure in December 1998. KCPT acted as the convener in this process and was able to do so in part because we are not competing with the colleges for students. KC REACHE members have created a remarkable culture of openness and sharing that did not exist previously. As we progress through the still relatively new field of online learning, each college has shared both its successes and its failures openly and in an atmosphere of candor. Each committee really represents an ongoing professional development association for its members. What the members learn from the committees, in turn, results in institutional development for each member's college.

The chart below shows the governance structure of KC REACHE:



The KC REACHE Board, which meets annually, has delegated operating authority to the Steering Committee, which consists of whoever is the chief decision-maker about distance learning at that institution. This includes Deans of Academic Affairs, Directors of Distance Learning, and Directors of Continuing Education, as well as the Director of Adult Education at KCPT. Four sub-committees report to the Steering Committee: the Student Services Committee, which consists primarily of each institution's Dean of Student Services; the Library Committee consists of Directors and Assistant Library Directors; institutional IT representatives sit on the Instruction & Technology Committee; Directors of Marketing recommend marketing strategies for KC REACHE. The Steering Committee and each sub-committee meet 2-3 times per semester. The Steering Committee has charged each sub-committee to select one (or more) project per year to undertake and present to the Board at its annual meeting.

Addressing the Needs of Distance Learners in the Greater Kansas City Area

In 2000-2001, national research and our own internal research within KC REACHE pointed to the same problems: distance learners felt disconnected from faculty, other students, and the institution (Kendall, Moore, Smith, Oaks, 2001; Dirr, 1999). In addition, the dropout rate for online courses was approximately 20% higher for online courses than it was for on-ground courses. KC REACHE sought to address this problem in two ways: 1) by developing the "branch campus" model of shared services, which allows distance students to access selected services from any member campus; 2) by developing communities of learners that connects online students with each other and with on-ground students. These services would go beyond what is known as the "administrative core" (WCET LAAP Project, 2000-2002). We would place special focus on adult, online learners. In the Fall of 2001, KC REACHE received a three-year FIPSE grant from the U.S. Department of Education to develop these services. KC REACHE's vision was thus validated on national level.

Branch Campus Services

Developing the "branch campus" services has generally gone smoothly. In the first two years of the grant, all KC REACHE colleges have opened up their libraries, their Testing Centers, and their Career Centers to one another's students. Students indicate that they are enrolled at one of the KC REACHE colleges, and they are able to use these services at one of the other colleges, if that is more convenient for them. These services help enough students to show that they were worth developing, but no one's resources have been strained. We expect that other consortia will be able to replicate this model fairly easily.

Communities for Online Learners

Bringing together online students in communities of learners has proved far more challenging. Our approach was based on the theory of "student involvement," developed by Astin (1984), Tinto (1990), and others. Astin defined "involvement" thus:

> . . . the amount of physical and psychological energy that the student devotes to the academic experience. Thus, a highly involved student is one who, for example, devotes considerable energy to studying, spends much time on campus, participates actively in student organizations, and interacts frequently with faculty members and other students.

For the purposes of the FIPSE grant, we were not concerned with the amount of time that adult online students spent studying, and by definition, these students did not spend much time on campus. What we attempted to increase was their interaction with students and faculty by opening up traditional student organizations to online students. We targeted academically related student organizations, especially if they were tied to an academic major. In this way, we believed we would increase their interaction with faculty and students in a meaningful way. This would lead to a greater sense of community and connection with the institution, thus leading to increased retention rates.

While Astin's research was based on traditional age, campus-based students, we felt encouraged by recent research that indicated that adult students benefit as much as traditional students from involvement (Graham, Long Gisi, 2000). Our experiment was to test this theory on a subset of that population: adult, *online* students.

Opening Up Existing Organizations

The theory that online students would be interested in participating in organizations directly related to their field in interest encouraged us to develop relationships with established on-ground student clubs. KC REACHE established ties with four student organizations during the first semester of the grant (Fall 2001). These included chapters of SIFE (Students in Free Enterprise), MOSAIC (Making Opportunities For Students to Appreciate Inclusiveness), TOT (Teachers of Tomorrow) and Phi Theta Kappa (a Community College Honor Society). Two of these clubs (SIFE and TOT) focus on future careers. MOSAIC initiates activities around significant social issues, and Phi Theta Kappa provides social activities and a membership to put on your resume. Work with these groups included the provision of a web page on the KC REACHE website and monies for the groups to promote their willingness to work with online students, as well as partial funding for on-ground meetings and events that included online student participation. These provisions were made so long as the groups upheld their agreement to recruit online student members and arrange activities that would be of value to the distant learner.

We learned several lessons from these pilot alliances with student organizations. Most importantly, we learned the importance of communicating to them repeatedly what KC REACHE is and what its mission is. The knowledge possessed by the high-level administrators who sit on KC REACHE committees does not necessarily filter down to the students. Since our organization and mission were unfamiliar to them, sustained effort did not always follow initial enthusiasm.

At times, these organizations did not actively reach out to online students. When they did reach out, we often failed to create events that elicited online participation. In addition, all of these initial groups are based in community colleges, whose student organizations struggle tremendously to generate participation because all of their campus-based students commute. Reaching out to the online population, that doesn't want to commute, added another level of challenge.

We at KCPT had anticipated this difficulty and attempted to use news groups as an Internet-based communication tool that organizations could use to reach online students. The newsgroups, however, are difficult to use unless one has above average technical savvy, and the web-interface that we created was unattractive and also somewhat difficult to use. We finally found an easy to use freeware bulletin board (Phorum) in the middle of Year Two. This has improved communication somewhat, but the challenge continues to be to create compelling reasons for students to visit it frequently.

The inconsistent responses and energy levels of student-led organizations also proved challenging. It is critical that communication be conducted on a frequent basis when trying to coordinate meetings and events – if responses are delayed or inconsistent, windows of opportunity are missed, and momentum stalls. Some groups responded enthusiastically by providing web-page content that would reside on the well-trafficked KC REACHE website, but regular updates and the creation of interactive components proved too taxing to the student resources that were available. As mentioned, publicity was a prickly issue because we still did not have a consistent mechanism for communicating with students about time-sensitive events.

Even when online students became aware of these organizations' outreach, however, they frequently decided that they did not have the time to participate with a group they deemed to be essentially social in nature. Several of the organizations had participation requirements for their members that online students did not feel they could complete, either due to time constraints or the need to commute to a college campus. Much of this feedback came to us through our Year One survey of online students. It did not appear that these organizations were meeting the needs of online students.

The next course of action, in Year Two, to integrate distance learning students and traditional on-campus students was built around a previously successful on-ground event in which students from several KC REACHE colleges had participated, although not collectively. A regular area event, the Heartland Pride Association's Gay Pride Parade, had seen involvement by a number of KC REACHE schools' students groups. KC REACHE set the goal of persuading LGBT groups from the KC REACHE campuses to work together to participate in the parade and to reach out LGBT online students. The Dean of Student Services at Johnson County Community College said that they had been fairly successful at providing community for LGBT students because of the anonymity that the online environment provides. The Student Services Coordinator for KC REACHE worked with Student Services representatives to contact campus diversity clubs. She encouraged these groups to organize and to walk in the parade as a KC REACHE group. KC REACHE agreed to cover all costs of parade participation. By this time, we had begun to develop e-postcards that could be delivered through our IT committee to faculty and students. KC REACHE used this method to communicate about the Gay Pride Parade to online students. KCPT provided students with an electronic bulletin for discussion and event planning. Promotion was also done through a KC REACHE booth at a local AIDS Walk event and work with the Lesbian-Gay Community Center of Greater Kansas City. Several student groups responded with enthusiasm, but when the parade was held, students chose not to participate with the KC REACHE group.

Reasons for limited success with the consortium event were varied. Again, students were unfamiliar with KC REACHE and its mission, and unsure as to how it related to their mission. While LGBT organizations reach out to a marginalized population, they are nonetheless very traditional organizations in terms of how they function. The Heartland Pride Parade is somewhat carnivalesque in nature, and it may appeal more to traditional age students who need to affirm their LGBT identity. LGBT adults at a different developmental stage may not have found the event as appealing. We did see one KC REACHE member school marching under their own banner.

Student Involvement vs. Professional Development

What we discovered in no uncertain terms was that adult, online students do not want to get "involved" in anything that adds to their already hectic lives. Our surveys, our focus groups (coordinated by our FIPSE evaluators), and several failed attempts to create student organizations that intentionally reached out to online students confirmed this lesson. Adult, online students, who are typically holding down a full-time job and/or taking care of families are simply not interested in getting "involved" in more activities. They did indicate, however, a desire to participate in activities that advanced them toward their academic and career goals. They were interested in activities that they could put on their resumes. This realization led to a major conceptual shift in our approach.

Instead of inviting adult students to engage in sustained involvement in organizations for which they would have some responsibility, we are developing a series of discrete, independent events that they can opt in and out of as they wish. A preference for periodic participation rather than sustained involvement is the key concept. Research has clearly documented that adult students have a consumer mentality when they choose colleges and programs, and part of this mentality is they expect to have no more demands on their time than are necessary (Roach, 2002). These events will include student feedback for online faculty, an online session with career counselors to discuss resume building, interview skills, and job search tips. This model has the best chance of working with adult, online students. It is the model followed by our most successful online student organization.

KOSO: KC REACH Online Student Organization

One collaborative online student group that has seen success is KOSO (KC REACHE Online Student Organization), an organization comprised solely of online students from KC REACHE member schools. Begun as a student mentoring program, the group has evolved into an organization dedicated to providing a voice for online students. One goal of the original grant proposal to FIPSE was the provision of tutoring and mentoring for new online students by their peers (Aquino & Wilkinson, 2002). We discovered early on that there were too many liabilities involved with peer tutoring (e.g., time and expense of proper training, lack of participants representing each consortium institution, limited availability of student mentoring time and heavy demand for services). Peer mentoring by students who had been involved with online classes for several semesters seemed manageable. The pilot mentoring project involved ten KOSO students. Services were announced through the KC REACHE website. Mentors were excited about the project and anticipated questions from students about how online learning works, time management and requests for tips for non-traditional students. They were inundated instead with requests for technical assistance.

The KOSO organization's first mission change was to drop the mentoring program. As intended in the FIPSE grant, however, they would still serve as a student advisory board for KC REACHE. The group served as focus group participants for KC REACHE student services planning as well as a focus group for FIPSE grant evaluation. Energized by opportunities to have their collective voice heard by people in positions of academic power, they submitted proposals to present at various student services and online education conferences. Three of the KOSO's student leaders led a panel discussion with approximately thirty faculty members at a regional distance learning conference in August 2003. They have also submitted a proposal to present at the NASPA student services conference in March 2004. These events showed us what adult online students are looking for. Meetings with KOSO members revealed that they are interested in professional development, networking, and other participatory events that will enhance their resumes.

Communication with Students

As mentioned previously, KC REACHE began with the very limited purpose of serving as a telecourse licensing consortium. When KC REACHE leaders decided in 1998 to broaden the mission to include comprehensive academic programs and student services, we faced the challenge of communicating that mission to staff, faculty, and students. Internal marketing has emerged as one of our biggest challenges. Many college faculty and staff do not promote KC REACHE to their students because they are unaware of it themselves.

Early on in KC REACHE's history, KCPT licensed WebCT and provided course hosting services for several of the colleges. Under the pressure to integrate courseware with new student information systems such as SCT Banner, Pipeline, etc., the course hosting function has migrated back to the colleges. KCPT ceased hosting courses at the end of Year One of the grant. Shortly thereafter, we settled on the e-postcard concept but no longer had control over where to place the announcements. In a recent meeting with KOSO students, we asked them to show us where a recent KC REACHE announcement appeared on their homepage. We found many inconsistencies in where the announcements are placed and how they are labeled. We also found that our instructions were often misunderstood with regard to what the announcement was supposed to look like. This is not due to lack of effort on the part of the colleges. It is the result of the information passing through so many hands before it finally reaches the student.

We will continue to work on smoothing out this e-postcard process, but we also will attempt to work around it by using our capabilities as a public television station. While we will not be able to advertise time-sensitive events, we are creating TV spots that will drive viewers to our website, where they will find information about KC REACHE services and events. Students who are introduced to online learning via our advertising and website are perhaps more likely to pay attention to KC REACHE information when it is posted and more likely to be repeat visitors to the website.

Evaluation

Our FIPSE grant evaluators have proved invaluable for ascertaining what services students are interested in and how to most effectively deliver them. They created a survey that we distributed online through the IT sub-committee and attached to every online course at the end of Spring semesters for each year of the grant. Online students completed these surveys on a voluntary basis. The surveys asked students how likely they would be to use library, career, testing, and tutoring services, and how likely they would be to attend on-campus events. The surveys included space for student comments. Students were given the opportunity to express why they felt what they did and what could be done to provide them with a more satisfying academic experience.

The findings were revealing. Demographic information indicates that the majority of KC REACHE students, especially those who take courses almost exclusively online, are of non-traditional age and are involved in full-time careers and have family obligations. The vast majority are female. Narrative responses indicated that students are not interested in participating in on-going activities and clubs. More appealing are discrete events that allow students to participate as their time and interests permit. They are seeking professional development opportunities where they can learn specific skills, gain relevant information, work towards a specific cause, or, most importantly, participate in an activity that will benefit their resume. Resume-enhancement has emerged as a key attractor for this population.

This, in turn, has led us to consider a different theoretical base for our final year activities. Schlossberg, Lynch, and Chickering (1989) confirmed that most adults return to college because some other major change has occurred in their life that creates a need for further schooling. Designing our activities, our website, and all of our communication with their theory adult life transitions may prove a sounder course than basing our activities on Astin's involvement theory. Without explicit reference to Schlossberg's transition theory, our Student Services Committee had already begun to reconceptualize KC REACHE student services as services that would assist students at "transitional moments."

With transitions in mind, the Student Services sub-committee has been re-energized as they have considered new ways to serve for this population of students. The sub-committee is working on providing a modified "First Year Experience" program for online students. This program would not be mandatory, as a freshman seminar is for so many new traditional students today. Instead, components of the program would be provided through one-hour online classes, KC REACHE events, web site information and resources provided on our KC REACHE CD ROM. Services would also include interactive components such as tests and measures to ascertain student learning styles and personality types (King and Hamilton, 2000).

Conclusion

When designing student services for adult online students for the final year of the FIPSE grant, KC REACHE will focus on developing separate, independent events that advance students in a clear way toward their academic and career goals. We will continue to develop KOSO as a vehicle to give online students a voice and an avenue for giving feedback about their online experiences within the consortium. Using Schlossberg's transition theory, rather than Astin's involvement theory, as a touchstone, we believe that we will provide avenues for student community and development that can be replicated by other colleges and consortia.

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Integrating Information Literacy into Elementary Social Studies in Taiwan

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Abstract

In an information age, schools should integrate information literacy into school curricula and educate children to be information literate. The purpose of this study was to develop and evaluate an integrated information literacy curriculum in social studies for elementary level. The collaborative action research was used in this study. The researcher and a fifth-grade teacher collaboratively planned an integrated information literacy curriculum based on the Big6 approach. The methods of interview, observation, document analysis, panel discussion, and surveys were used for collecting data. The results showed that the information literacy could be integrated into related content areas, so that they both could be beneficial. However, it should be well planned in advance, in order to avoid the problems occurred in the process of integration.

Introduction

The overwhelming flood of information bombards us in an information age. A citizen of the 21st century will encounter a continuous stream of news and information broadcasts, as well as the two-billion homepages and one-half-million images available through the World Wide Web (Kranich, 2000). However, more information will not create a more informed citizenry automatically unless people know how to use information efficiently, effectively and creatively. These digital illiterates usually do not know how to access suitable information competently, neither can they evaluate information critically, or distinguish the differences among various formats of information. The end result of this trend is that people in the information age cannot solve problems or make informed decisions in their real lives. Thus, many researchers suggest that schools should integrate information literacy into the context of classroom curriculum, and educate children to be information literates, who can recognize, locate, evaluate, use and create effectively the needed information (AASL & AECT, 1998; Breivik & Senn, 1998; Johnson, 1999; Todd, 1996; Chen, 2001; Bruce, 1997; Pappas & Tepe, 2002).

The social studies are the study of political, economic, cultural, and environmental aspects of societies in the past, present, and future (Barr, Barth, & Shermis, 1977; Czarra, Collins, & Smith, 1998). For elementary school children, social studies have several purposes. One of the purposes, which is congruent to the concept of information literacy, is that the social studies provide students with the skills for productive problem solving and decision making, as well as for assessing issues and making thoughtful value judgments (NCSS, 1989; Woolever & Scott, 1988). Furthermore, the National Council for Social Studies (NSCC) has been in the process of revising their standards for years and finally published a report called *Curriculum Standards for the Social Studies* (NCSS, 1994), which emphasized that all students need practice in information literacy skills. However, researchers warned that the process of information literacy required not only the learning of a constellation of *skills*, but also a new way of *thinking* in order to derive meaning from learning (Carey, 1997; Chen, 2001; Taylor & Patterson, 2000).

Are there any strategies or models suitable for teaching a new way of thinking in social studies? The Big6 approach is one of the possible strategies, which is a process model of information problem-solving that encompasses six unlocked stages. Despite several studies recommended this approach was appropriate for the integration of information literacy, little empirical research results have been verified yet (Eisenber &. Berkowitz, 1999, 1996; Edlund, 2001). In addition, this type of integrated information literacy curriculum has never been investigated thoroughly in Taiwan. Therefore, more research should be conducted to explore how to effectively integrate information literacy into social studies. Is the Big6 approach a good choice for the integration process? Are there any things need to be aware? And finally, what kinds of changes do school curricula have to make in order to put the integration of information literacy into practice?

Research Questions

The purpose of this study was to develop and evaluate an integrated information literacy curriculum in social studies for elementary level. Specific purposes related to the problems were as follows:

1. To develop an integrated information literacy curriculum in social studies.
2. To investigate elementary children's performance in the integrated information literacy curriculum in

the social studies.
3. To examine problems occurring in the process of integration in elementary school curricula.

Methods

Research Design

The collaborative action research was used as a framework in this study. The researcher and a fifth-grade elementary teacher (Ms. Chang) collaboratively planned an integrated information literacy curriculum and evaluated its effectiveness. This integrated curriculum was designed based on the Big6 approach. In other words, the set of six distinct stages that comprised the Big6 problem-solving method was highlighted. They were task definition (TD), information seeking strategies (ISS), location and access (L&A), use of information (UI), synthesis (S), and evaluation (E) (Eisenberg & Berkowitz, 1999). Within the study, the researcher and the teacher continuously kept on a dialogue and reflected on the process of the research.

Research Site

The research was conducted at Sun Elementary School (a pseudonym), which was in the urban southern part of Taiwan. The total of students in this school was about 1,700. This school had two computer labs which both could connect to the internet, and a library media center which owned about 8000 print and nonprint materials.

The research site was a fifth-grade classroom. There were thirty eight students in the class. Within the students there were great differences in academic achievements and learning attitudes. As Ms. Chang, the collaborative teacher noted, "Their differences are so big…some are totally behind. Since they are just grouped into a class, so they are always disputing and arguing." (int Chang, 11/23) Nearly all students were also busy with other after-school activities, e.g., mathematics, English, arts, etc.

Ms. Chang has been an elementary teacher for eighteen years. Her personality was warm but assertive. She loved to utilize various learning resources to help children carry out different projects.

Research Process

1. Stage of Preparation (4/2001~9/2001)

First of all, the researcher collected a variety of resources about information literacy, Big6, and social studies, so that the direction of this research would be more comprehensible. Then the researcher searched for a collaborative teacher in the near area. As a result, Mr. Chang showed that she was interested in this research because she encountered some problems last semester when she taught social studies in a framework of inquiry learning (rft, 4/20).

2. Stage of Collaborative Action (9/2001~12/2001)

Since there would be a mayoral election in December, after several discussions, the researcher and Ms. Chang selected the unit of Government and People in the textbook as the social studies theme for integration of information literacy. This action project, called "Electing a Good Mayor", provided students with a real social context, so that they could transfer the abstract concept into their real lives. The project was designed based on the Big6 for student exploration (Eisenberg & Berkowitz, 1999). First of all, students were organized into six groups, then started to define the tasks involved in the project, then decided the best seeking strategies and located various types of information, e.g., books, internet, newspaper, or human resources. After getting all of the needed information, they read, viewed and heard different types of information. Next, the students synthesized the main concepts of the theme and presented their projects in suitable types of media. Finally, the teacher asked students to do a self- and peer-evaluation of the effectiveness and efficiency in all stages they have experienced. Within this action project, the different types of literacy like library, visuals, media, computer, and network were all emphasized and intertwined in the social studies theme. Periodically throughout these stages, Ms. Chang and the researcher met with each group students to check on their progress.

Data Collection

Research data collected included participant observations (vid), researcher's field notes (rft), interviews (int), questionnaire (que), student notebooks (sn), and student written reports (sp). All the interviews were recorded and transcribed, and the observations were videotaped and transcribed too. These different types of data were chosen to best illustrate perception as well as to triangulate results for more credibility.

Data Analysis

All of the data were organized and coded based on the types of data and date. For example, *rft 4/20* meant the researcher's field notes written on April 20. Then, these materials were read and analyzed continually by the researcher, so that salient categories could be identified. These categories thus represented different perspectives drawn from the whole data set.

Results

The Integrated Information Literacy in Social Studies Curriculum

For the elementary level, there are three units in the social studies textbook each semester and each unit has to be completed averagely in thirteen periods. However, since the new curriculum put into practice in Taiwan last year, the instructional time was reduced. Thus, short of teaching time was always Ms. Chang's concern, "Now our classes are in a tight time frame. We don't have time to do any remedial instruction. Math, language art…are all behind schedule..." (int Chang, 10/30). For integrating information literacy into the curriculum in a limited time, more abstract and confusing concepts in this unit were discussed in the class, while fact-based knowledge was assigned to students for self-reading. The teaching strategies employed often were group discussion, group presentation and concept mapping.

According to Ms. Chang's observation, these fifth graders were not familiar with information skills such as library classification, use of encyclopedia, newspaper reading, as well as interviewing skills (int Chang, 10/10). Therefore, these topics were the main focuses in the information literacy of this integrated curriculum. Due to the space constraint, following table was the concise version of the integrated curriculum design (see Table 1):

Table 1: *The Integrated Information Literacy in Social Studies Curriculum (concise version)*

Learning Objectives of Social Studies 1.1 Understand the process of government formation	1.2 Understand the functions of government
1.3 Identify the organization of local government	1.4 Identify the levels of local government
1.5 Understand the ways of officials creation	1.6 Comprehend the meaning of election
1.7 Solve social issues through a democratic process	
Learning Objectives of Information Literacy 2.1 Take notes	2.2 Understand library classification system
2.3 Utilize various types of encyclopedia	2.4 Read newspaper
2.5 Define the task of the inquiry project	2.6 Attain information seeking strategies
2.7 Find needed information	2.8 Use information
2.9 Organize and present information	2.10 Evaluate the results and process

#	Objec-tives	Big6 Stages	Instructional Contents (in classes)	Student Learning Activities (after classes)
4	1.1 2.1 2.2 2.3	L&A UI	● Teacher taught how to take notes and students took notes during the class.* ● Teacher gave previewed questions. ● Students role-played the process of government formation and discussed it. ● Teacher explained the library classification system and the index of encyclopedia.	● Students answered the previewed questions using different information sources. ● Students completed the library activity sheet.
3	1.2 1.3 2.1 2.3 2.4	L&A UI	● Teacher taught how to read newspaper. ● Teacher and students discussed government's functions. ● Teacher explained the organization of local government. ● Teacher gave previewed questions.	● Students answered the previewed questions using different information sources. ● Students completed the newspaper activity sheet.
4	1.4 1.5 2.1 2.3 2.5	TD L&A UI	● Teacher explained the levels of local government. ● Teacher explained the ways of official creation. ● Teacher explained the Big6 process	● Students answered the previewed questions using different information sources. ● Each group completed the concept map. ● Students collected various sources of

	2.6 2.7 2.8		and gave the project. ● Teacher taught how to organize information. ● Students in groups discussed traits of a good mayor. ● Teacher and students discussed a candidate's concept map. ● Teacher gave previewed questions.	information about the selected mayoral candidates.
2	1.6 2.1 2.5 2.6 2.7 2.8	TD ISS L&A UI	● Teacher reviewed how to read newspapers. ● Each group presented the candidate's concept map. ● Teacher and students discussed information seeking strategies.	● Each group discussed possible information seeking strategies based on the concept map.
6	1.6 2.1 2.5 2.6 2.7 2.8	ISS L&A UI	● Teacher taught how to conduct an interview with a candidate. ● Each group interviewed the selected candidates.	● Each group brainstormed a list of questions for interview. ● Each group listened to the recorded interview tape and classified the content based on the concept map. ● Each group collected various sources of information about the selected mayoral candidates.
6	1.6 1.7 2.1 2.8 2.9	ISS L&A UI S	● Teacher clarified the contents of a written report. ● Each group designed a poster in the art class. ● Each group presented its projects with a poster. ● Peer evaluated other group's presentations.	● Each group synthesized all needed information. ● Peer evaluated other group's written reports.
2	1.7 2.1 2.10	L&A UI S	● Teacher arranged a mock election activity. ● Students cast their votes. ● Teacher and students examined problems occurred during the activity.	● Students reflected on the results and process of their work.
1	1.7 2.1 2.10	E	● Each group presented their reflections. ● Teacher debriefed with the class about the whole project.	● Students answered questionnaire.

meant numbers of classes. Each class lasted 40 minutes in Taiwan. * Students took notes in each class.

Student's Performance in the Integrated Curriculum

On the whole, there were thirty-four fifth graders from thirty-eight stated in the questionnaire they liked this integrated curriculum. Some of their reasons were collected as the following: "I don't need to dully memorize all the contents in a textbook" (que 25); "I felt I can learn things in the textbook with this teaching strategy. Meanwhile, I can learn many new things beyond a textbook." (que 8); "I don't have to just recite so many things. This teaching method let me experience the real situation and understand it truly.' (que 7)

As for the reasons for disliking this curriculum, the four students stated that: "I become anxious when I can't find any needed information. I am afraid I will be detained in the school." (que 18); "…because it is too much trouble, and I don't know how to present my work." (que 20) "We can't cooperate well." (que 38); "I don't know how to arrange the found materials. They make me confused…" (que 28)

As the comments above illustrated, most of the children had positive reactions to the integrated information literacy curriculum, while the students who felt negative to it were mostly lack of information skills. In fact, this was the focus of the integrated information literacy curriculum. The following were the analyses of student's performance of the integrated curriculum in social studies and information literacy. Due to the limitation of the paper length, only four more important learning objectives were selected for detailed exposition.

- **In the Area of Social Studies**

1. Comprehend the Meaning of Election

The researcher led students in groups to discuss traits of a good mayor with the concept mapping strategy. The group four selected character, work experience, and education as the most important traits of a mayor in its presentation. They asserted: "…He needs to serve on the city council or has some experiences like those before he can be a good mayor. Such experience can make him be more responsive to the citizens…" (vid 4, 11/12)

However, the issue of the government official experience became a dispute among students. One student noted, "I disagree with that. Serving on the city council doesn't mean he will provide good service. He may get our money, and get nothing done." The group four argued, "Nobody will vote a person who accepts bribes. The newspaper will tell it." Another student delightedly concluded, "You see, being an official is not a necessity for being a mayor. His service records are the main issue." (vid, 11/12)

Afterward, with the company of Ms. Chang and parents, students in groups interviewed the mayor candidates, as another source to help students make unbiased judgment. Through the series of discussion, information collection and analysis, interview, as well as a simulated voting activity, the fifth graders' progress in understanding the true meaning of election was shown in their notebooks: "Every citizen has the right to vote. We should appreciate it." (sn25); "We can't elect him only because he is our friend. We have to know his background and policy." (sn 14)

2. Solve Social Issues Through a Democratic Process

The unit of *Government & People* emphasized solving social issues through a democratic discussion. Thus, respecting the ideas of others was an important learning objective in this unit. However, fifth-grade students did not perform well in it within the whole process. The problems could be shown in the interviews with three group leaders:

"When one has an idea, another says it's not good. But he won't say his idea. So we have to change idea from one to one; finally we have a squabble and run out of time." (int 1er, 12/21)

"If we have 8 minutes for discussion, there are 7.5 minutes in a quarrel. Everyone has his own opinion, and don't want to listen to others. I was beaten by my group members." (int 4er, 12/21)

"One guy wants this piece of material, and the other wants it too. So they start to fight for it and it is pulled apart. Then we lost our piece of information again." (int 2er, 12/21)

The problems of working on teams and lack of democratic literacy were also illustrated in students' questionnaire, twenty-two from thirty-eight students felt teamwork was their most serious problem during the whole project. In other words, despite working on teams for a month, students still could not respect other's ideas. In the last reflection activity of this project, many students felt sorry about the tense relationship with others. Ms. Chang thus promised to give them more chances to improve their democratic attitudes. (vid, 12/17)

- In the Area of Information Literacy

1. Attain Information Seeking Strategies

Interview is one of the strategies for collecting candidate information. Ms. Chang facilitated students in groups to prepare higher-level interview questions and arranged the opportunity to practice them. As the following responses in the questionnaire illustrated, students felt it was the most valuable skill they have learned, "It boosts up my courage. I get some information not listed in the candidate' flyers. It's unforgettable experience." (que 31); "I noticed there were many volunteers helping out. It means a candidate can't win his election without other's help." (que 36)

On the other hand, during the interviews some students said they had difficulty in using tape recorders and taking notes, "…I am so nervous that I stammer a lot. I forget taking notes. The candidate doesn't answer my question in detail, but I don't know how to ask him more questions." (int 3, 11/23); "Although I interviewed our teacher before, this time is different. It is a mayor candidate now. I forget recording…" (int 4, 11/23); "Ms. Chang should let us practice more interviewing tasks, e.g., making an appointment, so we won't be afraid…" (int 25, 11/23)

As the comments above revealed, owing to the lack of chances to practice before, it was a great challenge to the students. Posing the following question, taking notes, and using the recorders were three tasks needed to be improved. These problems were also noted in the researcher's field note, "They don't jot down the notes right away. They don't know how to ask questions if the interviewee doesn't answer their questions. Most of them can sociably pose the prepared questions and have the eye-contact with the interviewee." (rfn, 11/21)

2. Synthesize and Present Information

Synthesis, the fifth stage of Big6 approach, emphasizes the integration and presentation of information from a variety of sources to meet the information need as defined (Eisenberg & Berkowitz, 1999). Ms. Chang and researcher asked each group students to present their mayoral candidate project to the full classes with a large poster and a written report. The criteria for evaluation included scope & depth, expression, layout, comments, and cooperation.

Each group presented its project on the selected mayoral candidates, then provided their reviews. Other groups could question them, and they had to explain further. As the group six synthesized the candidate's strengths and weaknesses in the presentation: "His strong point is that he loves to help people, while his weakness is that he likes to criticize a person." (vid, 11/26) After that, other students asked many questions about this candidate, such as how did he criticize others? What has he done for helping people? Ms. Chang was very pleased with their presentations and the process of interrogation in the social studies class (rfn, 11/26).

In the written report, the group two synthesized the candidate's traits in a table:

Category	Family	Policy	Education	Character	Service	Experience
Suitable for a mayor or not	Not	yes	So-so	So-so	yes	yes

Their remarks were that, "We find that this candidate has strong and weak points, but nobody is perfect. Based on the table, we find that this candidate has yes in three categories, while no in only one and so-so in two categories. So this candidate is suitable to be our mayor." (sp 2)

As the above data showed, fifth-grade students could synthesize and present information. They have mastered basically the Big6 stages.

Problems occurring in the process of integration in elementary school curricula

Time management and curriculum integration were real issues in this study. As shown in the table 1, the curriculum covered twenty-eight periods. Except the regular thirteen classes of social studies, some language arts and arts courses, as well as one Wednesday afternoon (for interviewing activity) were all drawn on for this project. Therefore, the lack of time has been great concern for the researcher and Ms. Chang. Ms. Chang was anxious, "I didn't have time to cover the part of central government in this unit, and students didn't quite understand legislators yet…" (int Chang, 12/20).

Curriculum integration is the center of the curriculum revolution in Taiwan lately. However, during this study, the science, mathematics, computer and language art all have independent instructional units and different assessment methods. Ms. Chang stated, "Our kids have had many different assignments recently. The science teacher gave them a research project yesterday…" (int Chang 11/23) In addition, Sun Elementary School held various sports and music activities this semester. All of these separated activities made students unable to concentrate on one or two core projects.

Discussion

The results of this study indicated that through an integrated information literacy curriculum, based on Big6 approach, fifth graders experienced a meaningful social action, and grasped abilities to access, organize, and evaluate information. In the area of social studies, they understood the meaning of election in a democratic society. However, performance in solving social issues through a democratic way was weak. Teamwork was the heart of the students' problem. More team projects might be the solution to this problem, as Pappas and Tepe (2002) stated, since students needed time and many opportunities to develop their knowledge and skills. More research needed to be done on this issue. As for the area of information literacy, their performance in interviewing improved greatly. However, posing additional questions, taking notes, and using tape recorders were three tasks which should be improved. Furthermore, most students performed well in synthesizing information. They could classify information according to the concept map, and provide their objective comments. Thus, in general, Big6 approach was suitable for integrating information literacy instruction across the contexts of subject areas.

Lack of instructional time and curriculum not-integration were two serious problems in this study. In fact, the abilities of "utilization technology and information", "active inquiry & research", "independent thinking and problem-solving", which were the centers of the new curriculum in Taiwan, all should be based on information literacy. However, information skills must be taught progressively and systematically. They could not be grasped and applied into different disciplines in a short term. These findings were consistent with those reported by Eisenbreg and Berkowitz (1999). On the whole, teachers, curriculum coordinators, and any persons who were responsible for curriculum development should do their best to integrate information literacy across all curricular areas. In this way, our children shall be successful in schools, in the workplace and in the world of the 21st century.

Educational Implications and Recommendations

There were several important implications and recommendations for educational researchers and educators to consider from the results of this study.

1. The information literacy could be integrated into related content areas of the curriculum, so that they both could be beneficial.
2. The concept of information literacy should be clearly defined, included, and well planned in the new curricula, in order to solve the problems occurred in the process of curriculum integration.
3. Teacher should arrange the whole semester or whole year curriculum which crossed different disciplines, then selected an appropriate theme for inquiring, in order to improve student's ability to participate in social lives.
4. The future study could investigate the teacher role and parent attitudes to the integrated information literacy curriculum, as well as the partnership between teachers and library media specialists.

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Not Just Spinning Logos...You Can Develop Performance Supporting Web-Based Back-End Database Systems Too!

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Abstract

Web-based database systems are often utilized as performance improvement tools in various areas of organizations. A few examples include course registration systems, employee directory systems, customer relationship management systems, and library catalog systems. Recent web authoring/development software allows non-programmers to develop fairly sophisticated web-based database systems within a considerably short timeframe, at a low cost, and without having to acquire professional programming skills. In this article, I will describe an example of an in-house developed web-based student enrollment tracking database system, which was developed to facilitate the administrative workflow of a multi-institutional distance education program. I will also explain the main steps for developing the web-based database system, using Active Server Pages with specific SQL and VBScript code.

When Spinning Logos Don't Improve Human Performance

Recent web technologies allow us to present multimedia elements such as animation and video clips in CD-ROM based e-learning materials or webpages. There are several animation software programs in the market, such as Flash and Shockwave. What are the main purposes of using animation in information presentation? Does it improve learning outcomes? Research seems to show inconsistent findings in terms of the benefits of using animation in learning materials. Some research studies have revealed that animation included in learning materials could improve learning outcomes (e.g.,Catrambone & Seay, 2002; Large & Beheshti, 1996; Norman & Patricia, 1999). Other research studies showed that animation did not facilitate better learning (e.g., Blankenship & Dansereau, 2000) and it rather distracted learners (e.g., Sperling, Seyedmonir, Aleksic, & Meadows, 2003).

How about effects of using animation in webpages? These days, it is virtually impossible to navigate through webpages without seeing one or two spinning logos or animated icons inserted in them. What benefits do animated icons inserted in webpages give to viewers? Spinning logos may gain attention from viewers for a short period of time and improve retention of information they viewed (e.g., Rae & Brennan, 1998). There also seem to be several pieces of anecdotal advice on how animation can increase organizational performance such as sales (e.g., Sharples, 1999). But experts in web design warn that extensive use of animated elements in webpages can distract viewers and decrease the usability (Nielsen, 2000). More importantly, few animations inserted in webpages are designed as performance improvement tools that web viewers use to reduce their performance deficiencies or improve their performance levels. What many organizations may not recognize is that the web can be utilized as an effective and efficient media for improving organizational performance instead. The current web authoring/development software helps them develop fairly sophisticated and highly effective web-based performance improvement tools such as web-based database (DB) systems in a reasonable timeframe without having to acquire professional programming skills.

Web-Based DB Systems Can Improve Human Performance

Some organizations may design web-based DB systems by programming from scratch, which gives flexibility in the design. Developing sophisticated web-based DB systems in a short period of time can be a challenge to many organizations and they may outsource the development and maintenance, which can be costly. Some organizations may use a WYSIWYG (what you see is what you get) web authoring software, which usually provides a broad range of built-in, ease-of-use functions. The 'power' and 'ease of use' are important factors, but the degree of 'productivity' is also an important factor for selecting an authoring tool (Fairweather & O'Neal, 1984). It is about how much or how sophisticated products you can produce within a certain period of time.

FrontPage, a product of Microsoft, is one of the web authoring software available for web designers, even non-programmers, to use. It is fairly easy to use and moderately powerful, and its productivity is considerably high. FrontPage provides a *Database Results Wizard*, which is a menu-driven, user-friendly environment. It takes users through the process of creating or selecting a database record source, choosing specific record fields, specifying criteria for filtering fields, and selecting sort order of selected fields. Within several clicks, by following the steps in the Database Results Wizard, users can create a database, generate necessary webpage interface, make a database connection between the database and the web interface, and set up webpages to populate data from the database. Users are not required to know a programming language to accomplish this task. FrontPage saves the webpages as Active Server Pages (ASP), in which necessary Structured Query Language (SQL) statements and VBscript code are automatically generated. More advanced web designers who are familiar with using SQL and VBscipt in ASP can customize the settings in the Database Results Wizard. They may also design customized ASP pages to develop various types of report systems.

A benefit of using a web-based DB system is that it functions as a centralized depositor of various types of information for multiple users at different locations. Users can disseminate new information by entering it into a web-based DB system, and update existing information instantly from anywhere at anytime. Upon request and within a couple of keystrokes, various types of reports can be generated and displayed to users. Such web-based DB systems are essential performance supporting tools for knowledge workers in the 21st century, who reply heavily on using dynamically and fast changing information.

In the following section, I will describe a case where an in-house development of a web-based student enrollment tracking DB system was utilized as a performance improvement tool. I will explain major steps of developing such a system.

A Case Where Web-Based DB Systems Improved Human Performance

The Subsurface Science Graduate Program (SSGP) is a federal grant based, "collaborative effort by the universities of the Inland Northwest Research Alliance (INRA) to enhance research and education in the subsurface sciences" (http://ssgp.boisestate.edu/). Eight universities in the northwestern region of the U.S. are participating in the SSGP graduate program. Students from the eight participating universities take SSGP distance courses via a synchronous videoconferencing system and a course management system.

Students in each university are registered in their home university's registration system, and it is difficult and time-consuming for the eight universities' administrators, instructors, and technology-support personnel to collect frequently updated student enrollment information from each participating university. Since the program is new and fairly small, it is not an option to purchase a learning management system to manage the SSGP graduate program's student enrollment information. If the participating universities do not share their student enrollment information with each other in a timely manner, it can create serious problems. For example, 1) some universities may fail to schedule the video-conferencing classrooms for their students, 2) students may not be able to receive course information from the teaching university on time, 3) instructors may not have information about their students, and 4) students may not have access to the course management system.

The participating universities recognized the performance problem as a communication problem, and decided to use a web-based student enrollment tracking DB system to share student enrollment information with each other more effectively and efficiently. By using the centralized student enrollment tracking DB system, they could enter new student enrollment records, edit student information in existing records, delete obsolete records, or search for student information by their name, course title, and home university, from their location, at anytime.

How the Web-based Student Enrollment Tracking DB System Was Developed

FrontPage 2002 was used to develop the SSGP's web-based student enrollment tracking DB system. FrontPage's Database Results Wizard generated a database editor system, which allowed users to create new records and edit or delete existing records (see Figure 1). The data were stored in an Access database in the server.

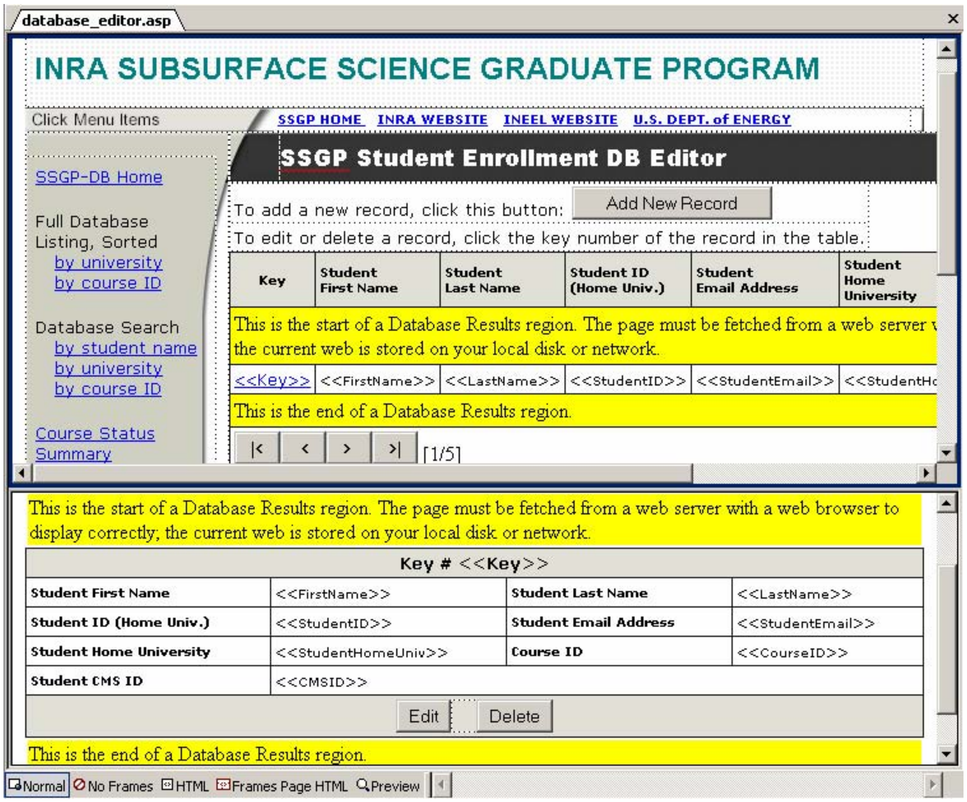

Figure 1: The Database Editor of the Web-Based Student Enrollment Tracking System

Another important feature of this student enrollment tracking DB system was the course roster report system. Since students from eight different universities were participating in the SSGP program, it was critical that each university's administrators be able to obtain course rosters that provided necessary information for supporting students as well as instructors.

A course enrollment status report page was manually designed by using FrontPage's database results feature with specific SQL statements. The report page was designed to allow users to select a course and populate the selected course information as well as the course roster (see Figure 2). In order to calculate the number of students currently enrolled in each course, a customized SQL statement was entered during the Database Results Wizard steps. The customized SQL statement used to count the number of the records that contained the selected course ID number was:

```
SELECT Count (courseID)
FROM Results
WHERE (CourseID =  '::CourseID::');
```

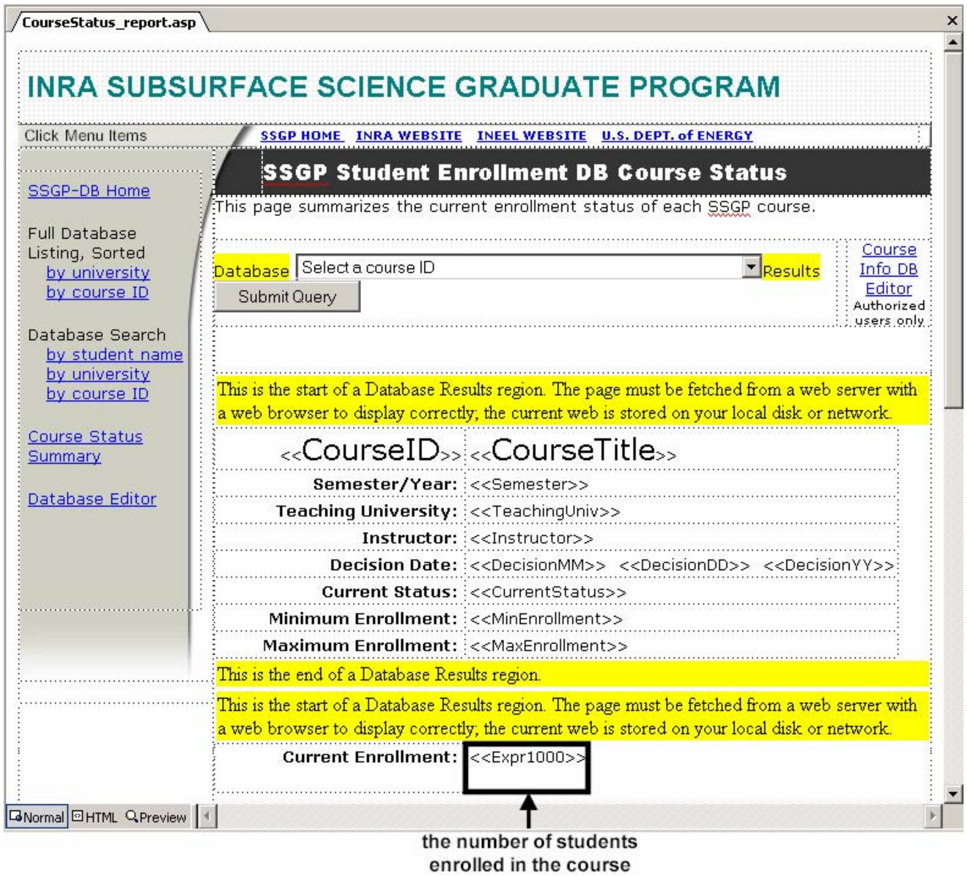

Figure 2: The Design of the Course Enrollment Status Report Page

More specifically, when a user selects the course title, SP03-001 Terrestrial Subsurface Processes II from the drop-down menu and presses the Submit Query button in this course enrollment status report page, the value ‘SP03-001’ is being processed by the server-side scripting engine. Then, the system screens through the records of the ‘Results’ table in the Access DB and locates records, the CourseID field of which matches the selected value ‘SP03-001’ (see Figure 3). The system counts the number of records that have matched. Then, the processed result is presented in the report ASP page (see Figure 4).

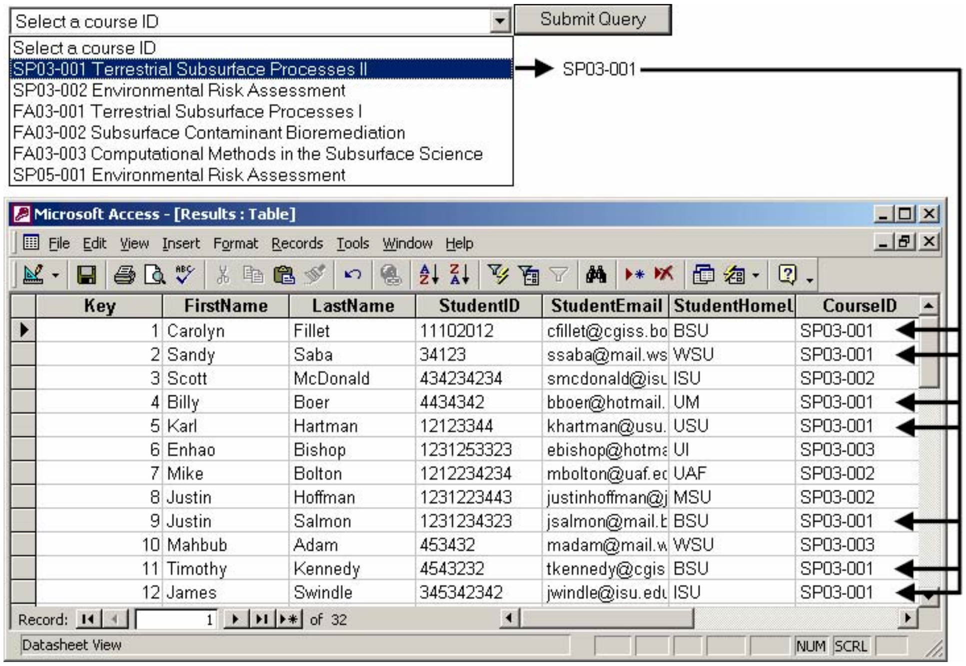

Figure 3: The Selected Search Item Is Being Used to Search Records in the Access Database

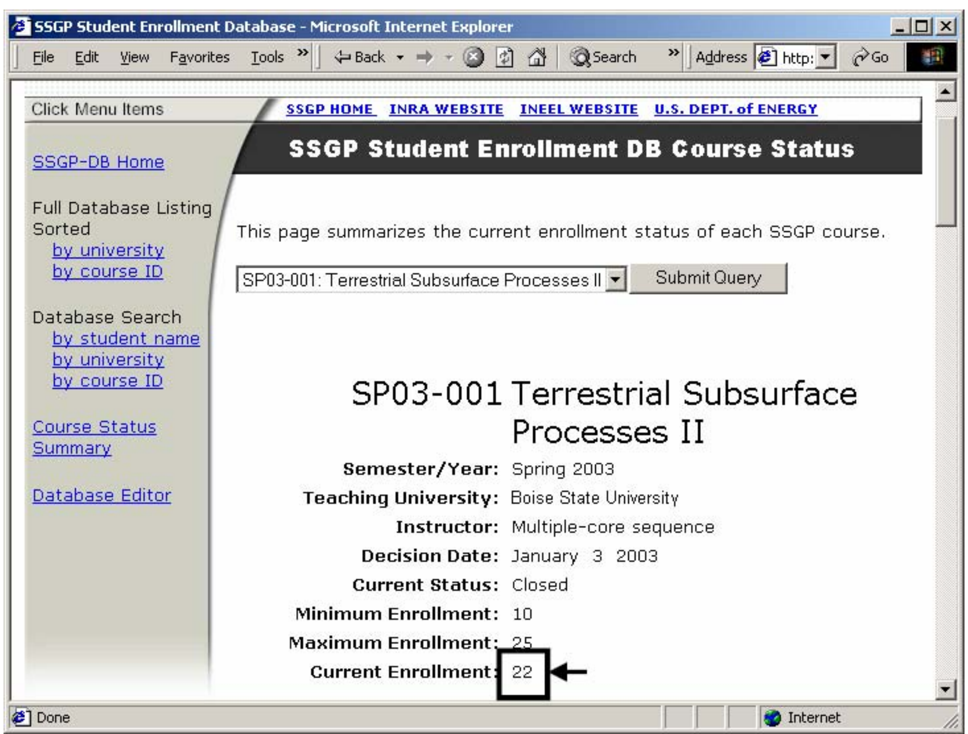

Figure 4: The Course Enrollment Status Report Page

Another feature added in the course enrollment status report page was a hyperlink that allowed users to download the report page as an Excel file (see Figure 5). The HTML code necessary to make a simple hyperlink to another ASP file called, CourseStatus_report_excel.asp, would be: <a href="CourseStatus_report_excel.asp">. In this case, the hyperlink needed to be set to send the value of the selected course ID (e.g., SP03-001) to the ASP page, CourseStatus_report_excel.asp. To do so, VBScript code <%=Request("courseID")%> was inserted after the

href tag followed by a question mark in the HTML: i.e.,
<a href="CourseStatus_report_excel.asp?courseID=<%=Request("courseID")%>"> (see Figure 6).

Figure 5: A hyperlink to Another ASP Page

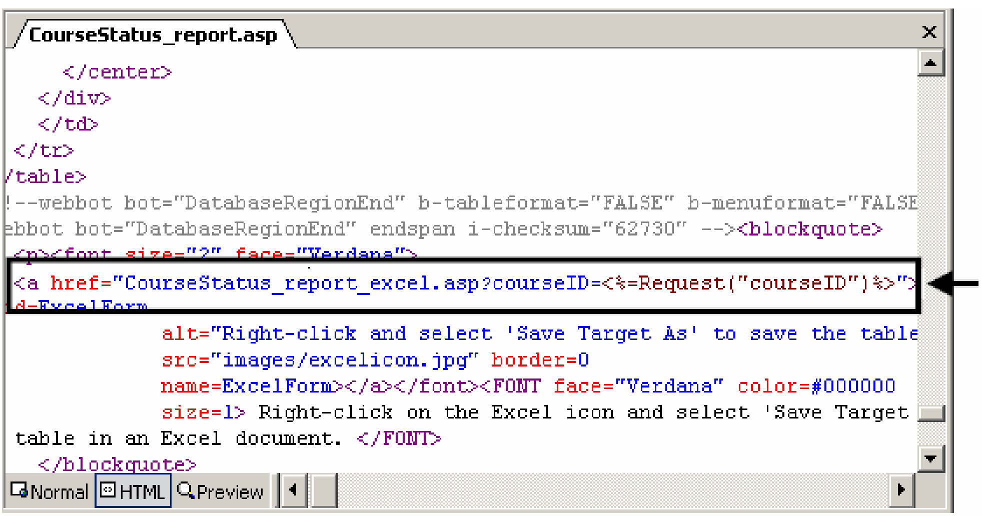

Figure 6: VBScript that Sends the Selected Course ID to Another ASP Page

Then the page, CourseStatus_report_excel.asp, was designed to populate the course roster using the value of the selected course ID (e.g., SP03-001). In this page, the following VBScript was inserted under the <body> tag: <% Response.ContentType = "application/vnd.ms-excel" %>. This VBScript was used to present or save the content of the ASP page using Excel application. In other words, when users were forwarded to this page, the system would activate to either save the page in an Excel document or open the Excel document in their browser depending on the users' choice of action and browser type.

Summary

Using recent web authoring software such as FrontPage, non-programmers can develop fairly sophisticated web-based database systems in a considerably short timeframe. In developing a web-based DB system, the use of server-side scripting is necessary. Server-side scripting such as ASP written in VBScript allows webpages to communicate with a database program such as Access stored in the server. A web-based DB system can be designed with various SQL statements to manipulate data stored in a database file – i.e., entering new records, editing existing records, and searching for specific records. Such web-based DB systems are excellent performance improvement tools for the knowledge workers in the 21st century. They provide dynamically changing information to multiple users at distance and help them improve their performance levels.

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The evaluation of the Garbage bunny: A theoretical evaluation

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Abstract

In this contribution a theoretical evaluation study is reported on the use of a pedagogical agent, the garbage bunny. This agent operates in an electronic learning environment where pupils learn about sorting garbage and recycling. Based on all sorts of information, pupils have to choose the most ecological alternative out of a range of products. The garbage bunny is developed to coach students in their problem solving process.
The evaluation consisted of the design of an optimal agent, based on a task analysis and research findings with respect to pedagogical agents. Next, the actual agent was compared to the theoretically ideal agent. Finally a comparison was made with three existing agents that also operate in a problem solving environment. The evaluation suggests that especially the object, adaptivity and delivery modalities need some optimization.

Introduction

Different authors have suggested animated pedagogical agents to be promising with respect to delivering adapted support to learners (e.g. Johnson, Rickel & Lester, 2000; Grégoire, Zettlemoyer & Lester, 1999; Baylor, in press). Such agents may adapt their support to learning paths of individual students and provide them with non-verbal feedback through means of facial expressions and gestures. They are designed to operate in an educational setting (Shaw, Johnson, & Ganeshan, 1999).

The use of open-ended learning environments with ample learner control strengthens the need of supporting learners in their task execution. Students are confronted with a complex or ill-structured problem that has to be looked at from different perspectives to generate a suitable solution (Spiro, Feltovich, Jacobson & Coulson, 1991). Given the complexity of the problem, students will need support on different levels, not only on the level of the content, but also on a problem solving and metacognitive level. Moreover, research in the aptitude treatment interaction tradition reveals a strong interaction between learner characteristics and instructional interventions (Snow, 1986; Snow & Swanson, 1992). For instance, the required amount of support depends on specific student characteristics such as prior knowledge (Ross, Rakow & Bush, 1980). Additionally, Clark (1991) demonstrated that both too much and insufficient support might be detrimental. Thanks to their potential to adapt support to learners, pedagogical agents seem to offer an opportunity for providing support to students when solving problems.

Sorting garbage and recycling can be defined as an ill-structured problem. Problems in this domain have to be looked at from different perspectives; not only the garbage itself, but also the production process, the basic products, the recycling process, and issues such as comfort for the users have to be considered. In this contribution an evaluation is reported with an electronic learning environment to help students learn about recycling and waste prevention. Since this environment, was developed as an individual learning environment, not necessarily used under supervision of a teacher, a coach was integrated to assist learners in their problem solving process. This pedagogical agent will be referred to as the 'Garbage bunny'.

This contribution is a theoretical review (Karat, 1997) of the garbage bunny.

Method

The evaluation focuses on the pedagogical agent in the software program. More specifically, support provided by the agent will be looked at. To do so, the categorization scheme developed by Clarebout, Elen, Johnson and Shaw (2002) is used. The different aspects of this categorization scheme are:

Object of support: support can be directed towards different aspects of the learning environment, i.e. content, problem solving, metacognition and handling technology.

Learner control with respect to support: Pedagogical agents can control the support and take the initiative to provide support or students themselves may take this decision and request support. An open learning environment by definition implies a great deal of learner control (Hannafin, 1995). However, since students seem not always capable of adequately choosing for themselves (Large, 1996; Williams 1996), and given that reviews on learner control do not reveal a consistent positive effect (e.g. Goforth, 1995), this aspect requires further consideration.

Adaptability of support: The required amount of support depends on students' prior knowledge (Ross, Rakow & Bush, 1980) and other learner characteristics such as students 'aptitude and metacognitive skills (Clark, 1990). Clark distinguishes between three levels of support: a) no support (only goal statement and information are provided), b) activation (goal statements, information and indications on how to process the information are provided) and c) compensation (instruction takes the cognitive burden, cognitive processing over from the learner. A gradual withdrawal of support is generally advocated (Collins, Brown & Newman, 1989; Jonassen, 1996; Vermunt, 1992). However, not only the amount or quantity of support can be adapted to the needs of students, but also the object of support, they may need support on a domain-specific level or on a metacognitive level for example. Either the program or the learner can determine the change in quantity and object of support.

Delivery modalities. The pedagogical agent can entail different delivery modalities, which might affect the effect of pedagogical agents on learning (Moreno, Mayer, & Lester, 2000). Pedagogical agents communicate verbally or non verbally. Reeves and Nass (1996) indicated that students view the interaction with a computer (pedagogical agent) as a social interaction, in which three features are essential namely, a) image, b) voice and c) personalized language. A pedagogical agent has by definition, an image. Hence this distinction is not included in the typology. However, the other two aspects are. With respect to verbal language pedagogical agents, can use either text or speech to communicate with the learner. Examples of nonverbal language are head nods and gestures to provide feedback. The pedagogical agent can communicate in a personal way and engage in dialogue or in a less personal way, namely through a monologue.

Timing of support: A pedagogical agent can deliver support either up front, by presenting for instance at the start of the interaction information the student will need to solve a task, or, just-in-time, during the execution of the task. It might also be that the agent provides delayed support by giving for example information about the process after task completion.

Support style: This dimension refers to the different roles and modalities of an instructional agent. Based on a literature, six typical roles for pedagogical agents are identified:

- Supplanting: the instructional agent assumes responsibility for the tasks and performs them for the learner. The learner observes the instructional agents while he performs the task (e.g. Salomon, 1994). This can be compared to what Clark (1990) called a compensation where (meta)cognitive activities are taken over for the learner.
- Scaffolding: the instructional agent performs those parts of the task that learners are not yet able to perform themselves (Collins et al., 1989, Jonassen, 1996). This might allow learners to perform on a level just above their current level, in their "zone of proximal development" (Vygotsky, in De Corte, Verschaffel & Lowyck, 1994);
- Demonstrating: the instructional agent shows how a task is performed after which they observe how the learner performs the task (Merrill, 1994);
- Modeling: the instructional agent shows how a task is performed while revealing and explaining his reasoning process. The instructional agent solves a task while he articulates how problems are solved, what strategies are used, and what mental model are necessary to understand the task (Jonassen, 1996)
- Coaching: the instructional agent provides hints and feedback, and activates the learner when the learner is performing the task. The instructional agent observes the learners when they are solving a task and provides guidance when students experience difficulties (Barab & Duffy, 2000) and
- Testing: the instructional agent tests the learners' knowledge about certain aspects of the task to guide the learning process (Martens & Dochy, 1997).

These different roles reveal four different modalities of support: a) executing, b) showing, c) explaining and d) questioning. Each of the above-described roles can be characterized by (a combination of) analytical modalities. For instance, if the role of a pedagogical agent is coaching, support can consist of a combination of explaining and questioning.

Figure 1 provides an overview of the categorization scheme.

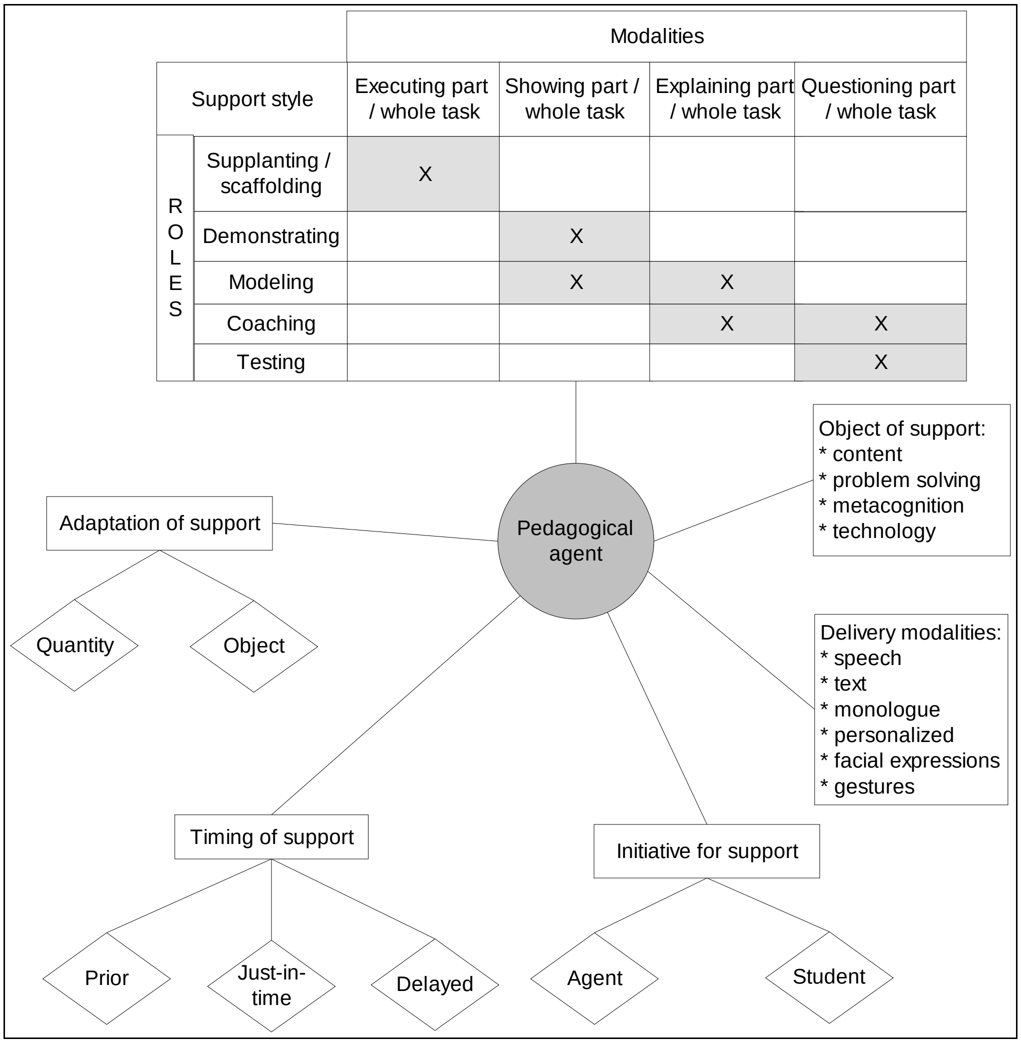

Figure 1: Categorization scheme

A theoretical evaluation of the pedagogical agent allows for detecting some weaknesses that still can be adopted before finalizing the product. Based on this categorization scheme an ‘optimal’ agent will be constructed. To construct this ‘optimal’ agent, use will be made of research findings relating to the effect of certain agent characteristics on learning.

Additionally the Garbage bunny will be compared to existing pedagogical agents that are also used in a learning environment with ill-structured problems (e.g., Adele, Steve, Herman the Bug).

Program description

The garbage program offers an environment in which students can develop their ecological awareness and skills by solving specific problems such as selecting the most ecological school materials.

Students enter a virtual school in which they are asked to select the most ecological product from different alternatives. They can click on different rooms: the lunchroom, classroom, and playground. In each of these rooms they are confronted with specific products that are often used, for instance pencils, glue, lunch packages. When clicking on a certain product, they receive information on that product, going from its raw materials, package, cost to comfort. In order to make their choice for the most ecological alternative, they have to consider not only the product itself, but the whole production process, comfort and prices. When students think they have collected enough information to select the most ecological product, they can do a test. In this test, different questions are asked on the different categories (comfort, production process, etc.) and the final question is “Which product is the most ecological?". When they give a "wrong" answer, students receive feedback on why their answer was wrong and are encouraged to continue their investigations. This also means that they can go back to the information section.

Evaluation

Optimal agent

Given the ill-structuredness of the task, students will not only need content information to solve it, but they will also need some problem solving and metacognitive skills to reach an adequate solution. As such, it can be expected that students will need support on these different levels. Support on a content level is provided by the program itself, students can access additional information by clicking on the products. The program does not provide support on a problem solving and metacognitive level. Consequently, it is expected that the agent will direct its support on those two levels. It is expected that the agent will coach the learners by explaining and asking questions. Additionally the agent might also model the problem solving process. Research findings show that students do not always make adequate choices with respect to their learning process (e.g., Clark, 1991; Large, 1996; Hill & Hannafin, 2001). Shaw et al. (1999) revealed that students prefer to request support of the agent, rather than automatically receiving it, but that they do not use it. Consequently, it seems advocated that the agent controls the delivery of adaptive support.

Most research with pedagogical agent has studied modality effects of agents. Different studies by Moreno and colleagues (Moreno, Mayer & Lester, 2000, Moreno & Mayer, 2000; Moreno, Mayer, Spires & Lester, 2001) showed that an agent using spoken personalized language leads to the best results. Atkinson and Mayer's experiments (submitted) revealed that a human voice resulted in better performance than a machine synthesized voice. In her research, Baylor (in press) focused on the comparison between a fully animated agent, a static agent and no agent. Apparently the fully animated agent was found to be more engaging, more person-like and to have a higher degree of credibility. However, the effect on learning was not studied. Concerning the timing of support delivered it is important that the agent delivers the support just in time. van Merriënboer distinguishes between information relevant to recurrent aspects (rules, procedures, prerequisites) and to non-recurrent skills (system, approaches and heuristics). Support for recurrent aspects should consist of just in time information and immediate feedback on the quality of performance of certain skills, while support for non-recurrent aspects should consist of both information presented up front and delayed.

Based on these findings the following theoretical optimal scheme of the Garbage bunny can be drawn:

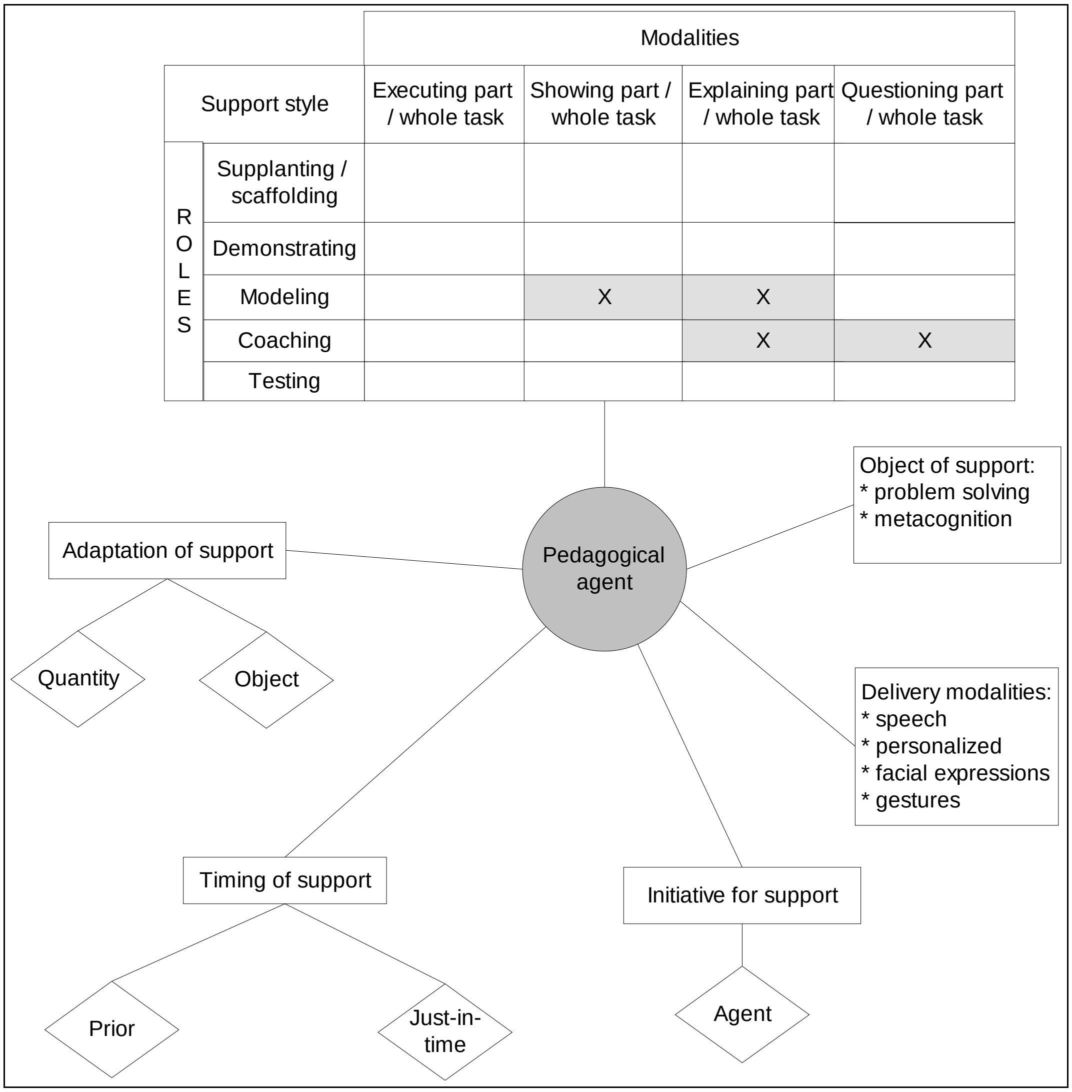

Figure 2: An optimal agent

Figure 3 presents the analysis of the Garbage bunny.

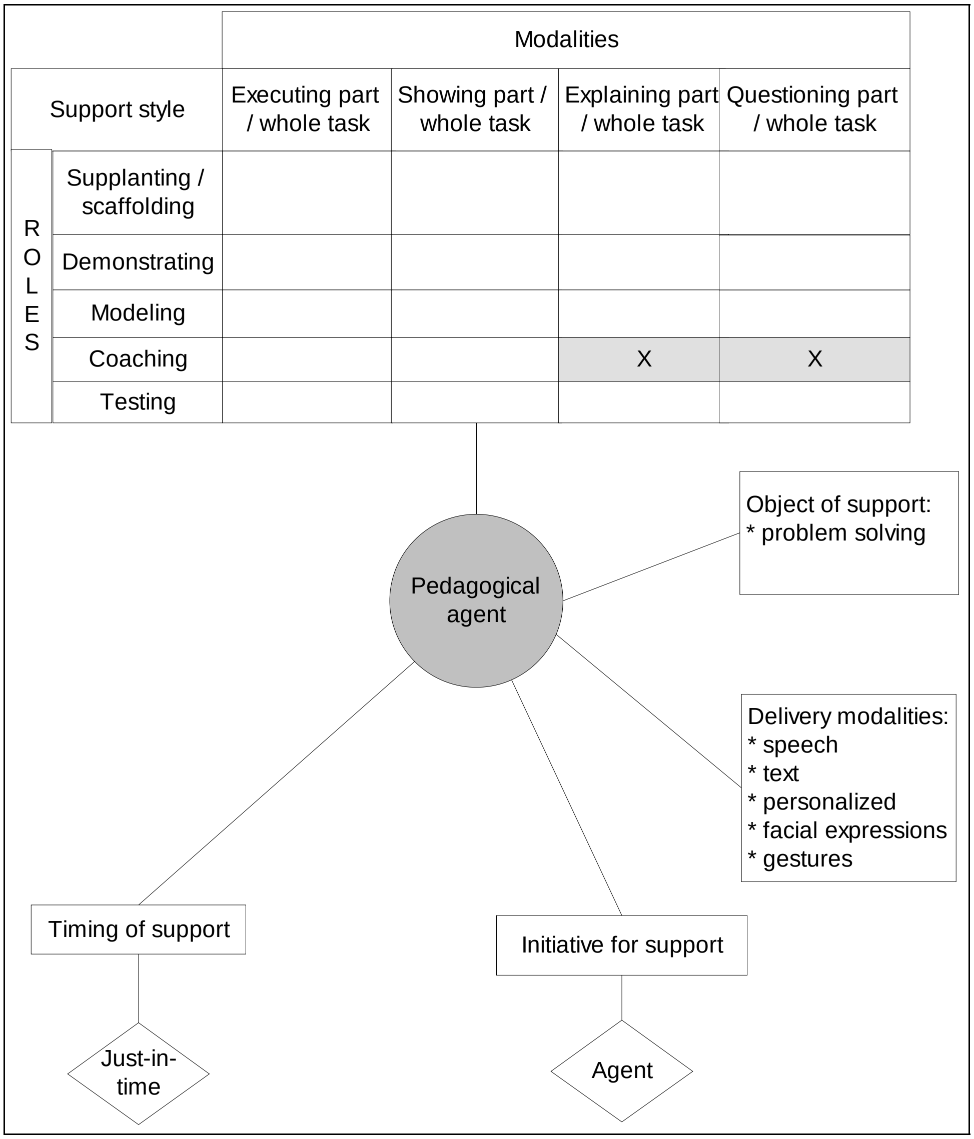

Figure 3: The Garbage bunny

Figure 3 reveals the following observations with respect to the different aspects of support:

Object of support: the pedagogical agent provides indeed support on problem solving level. When students enter a room or a new part in the program, the agent explains how they have to start with their problem. No support is provided on content level. This corresponds to the expectations, but in contrast to what was expected no metacognitive support is provided.
Learner control with respect to support: the agent determines itself when and what support is provided. The student cannot interact with the agent, cannot request for additional support or refuse additional support.
Adaptability of support: the Garbage bunny fixes the amount and object of support, no differentiation is made between students with different needs; the learning paths of the students are not taken into account. Moreover, if students return to a previous section or room, the agent will simply repeat what he said the first time.
Delivery modalities: The agent communicates verbally and non-verbally. Every time the agent says something through speech, the text of what he says is displayed as well. This written text remains on the screen until the learner starts a new action. This is in contrast to the expectations.
Timing of support: The Garbage bunny provides just-in-time support. It was expected that based on the kind of skills needed to solve the problem some information would have been provided in advance, that for the non-recurrent skills.

Support style: The Garbage bunny introduces the problem when students enter the virtual school He acts as a coach by providing guidelines to solve the problem and to work in the environment. He explains how to work and what to do. While in the ‘optimal’ agent the possibility was uttered that this agent would also model the problem solving process, this is not the case for the actual Garbage bunny.

Table 1 compares the Garbage bunny with three other previously analyzed (see Clarebout et al., 2002) agents that also serve as coaches in problem solving processes. The first agent is Adele (Shaw et al., 1999; Johnson et al. 2000, Ganeshan, Johnson, Shaw & Wood, 2000). Adele supports distance education in the domain of medicine and dentistry. She exists in three interaction modes. In the advisor mode she observes the student when performing an action. If this action is consistent with standard practice, Adele will interrupt the students and suggest another action. In the practice mode, Adele provides advice upon request of the student. In this mode, Adele does not interrupt the learner. A final mode is the examination mode. In this mode, Adele does not give advice during the task, but provides feedback after task completion.

Steve (Johnson et al., 2000) is an acronym for Soar Training Expert for Virtual Environments. He demonstrates “skills” involved in a specific task in a virtual environment. The student can walk around in the environment and look at Steve’s demonstration from different angles. The student can interrupt the agent and ask him to complete the task. When the students are performing the task themselves, they can ask Steve to show them what to do next. While Steve demonstrates part of the task he explains what he is actually doing.

Herman the Bug (Lester, Stone & Stelling, 1999). Herman is an alien with human-like movements and facial expressions. Herman inhabits a learning environment called “design-a-plant” for the domain of botanical anatomy of physiology. He offers advice about the relation between plant features and environmental features, encouragement when students encounter difficulties and feedback on their choices while designing a plant.

Table 1: *The Garbage bunny compared to other pedagogical agents*

	Pedagogical agents			
	Garbage bunny	*Adele*	*Steve*	*Herman the Bug*
Modality	Explaining	Explaining/questioning	Showing/ Explaining	Explaining
Role	Coaching	Coaching	Demonstrating/Modeling/coaching	Coaching
Object	Problem solving	Content/problem solving/ technology	Content/problem solving/ technology	Problem solving/ content
Control	Agent	Agent/learner	Agent	Agent
Adaptability	None	Quantity and object	Quantity and object	Quantity and object
Delivery modalities	Spoken / written Personalized	Spoken/written personalized	Spoken/ personalized	Spoken/personalized
Timing	During	During	Prior / during	During

The table indicates that for most characteristics the Garbage bunny is comparable to the similar agents. The different agents take the role of a coach by explaining different issues to the learner. They all provide support on a problem solving level, although the other agents provide additional support on a content and technology level. Similar to the Garbage bunny none of the others give support on a metacognitive level. The most striking difference relates to the adaptability of support. While the other agents adapt their support to what students are actually doing, the Garbage bunny does not.

Conclusion and discussion

This theoretical evaluation started with the design of an ‘optimal’ agent based on a task analysis and research findings with respect to pedagogical agents. The evaluation itself shows that the Garbage bunny deviates on three aspects from this optimal agent. A first aspect relates to the object of support. The Garbage bunny does provide support on a problem solving level, and not on a content level. However, no support was provided on a metacognitive level. While given the ill-structuredness of the task, it was expected that students would need guidance with respect to this aspects. Supporting students’ on a metacognitive level would mean helping them in planning and regulating their own learning process. Apparently, this seems to be a level of support that is ignored in most agent-related applications. The comparison with the three other agents that also operate in a problem solving learning environment, reveals similar results. A second point relates to the adaptability of support. Although Clark (1991) indicated that adapted support (both too much and insufficient support) might be detrimental, the support of the Garbage bunny is not adaptive. Even worse, the same support is provided every time when students return to the same point in the program. Further investigation might be interesting to determine whether this causes additional extraneous cognitive load (Sweller, 1988) or whether students just ignore it and continue working. A third difference with the optimal agent relates to the delivery modalities. Research results (Moreno & Mayer, 2000; Moreno et al., 2000; Moreno, Mayer, Spires & Lester, 2001) indicate that the use of spoken text leads to the best learning results in comparison to written text alone or a combination of written and spoken text. The Garbage bunny combines written and spoken text. Additionally, the written text of the agent remains until the agent starts to talk again.

Based on this theoretical evaluation suggestions can already be made for optimizing the pedagogical agent, such as using only spoken text to provide support, including support on a metacognitive level and adapting the support to the learners. However, questions remain with respect to the effectiveness of this agent:

Does the Garbage bunny help students solving the problem?
Does the fact that the Garbage bunny is continuously present effects learning?
Does the remaining of the written text hampers students learning?

An empirical study might provide insight in these issues. Some of this research issues demand the same application without an agent in order to compare the effects of the agent. This relates to a broader problem with the development of educational technology. Programs are being developed and released using the latest technology before they are actually tested. This is also the case with the Garbage bunny-program. Use is made of the latest technology, without any test phase. It reflects the gap between the pace of evolution in technology and research with respect to this technology. Often educational software is developed with the latest technology before actually asking questions whether this works, whether this has a positive influence on learning and for whom; without waiting for a firm research basis to justify the use of these technologies for learning.

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Retention through Service and Course Design

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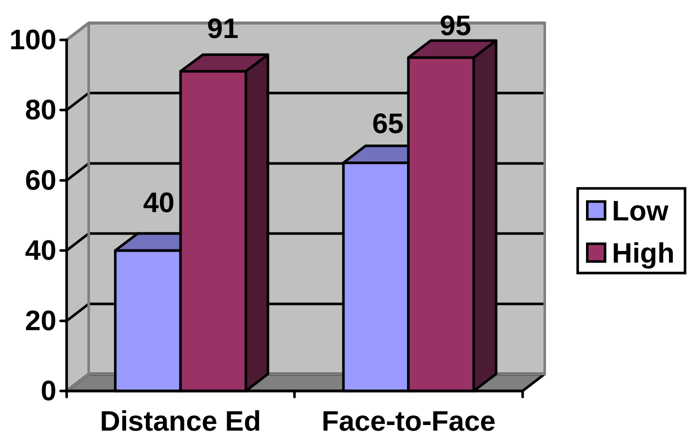
Abstract

The complicated issue of student retention in distance education (DE) courses has become a stumbling block for the success of the field as a whole. As few as 40% of enrolled students complete DE courses according to some studies. Is this the result of inexperienced faculty? Or the different perspective of the adult online student? Or, as some claim, the result of the isolated nature of distance education itself? A hierarchy of retention strategies is presented based on the retention experience in a nationally acclaimed online education master's program. Using a combination of course design principles and a proactive, mentoring and service minded faculty a completion rate of 94% was achieved over a 2-year period.

Now that distance education is becoming more accepted in mainstream education the retention of students is evolving as one of the critical issues in the field. Until the patterns of retention and student withdrawal can be identified and addressed distance education will not meet its goals of reaching a greater number of students (Brady, 2001). At present no national statistics on retention in individual courses or by programs exists. However, the majority of available anecdotal evidence points to completion rates in distance education that are consistently lower than those of traditional face-to-face programs (Carr, 2000).

The high withdrawal rate has become an unquestioned norm. A review of ten recent studies of retention and withdrawal shows a huge range of 40% to 91% of students completing distance education classes. These same studies cited higher completion rates of between 65% and 95% in comparable face-to-face classes. In one study the gap between distance education and face-to-face classes was only 4%. At the other extreme, a 26% difference was documented between the distance education students and the traditional track (Frew & Weber, 1995).



Meta Analysis of Students Completing Courses Distance Education vs. Face-to-Face

Professional Teacher Competencies Workshops offered through The University of Northern Iowa (UNI) did not experience this kind of normative high attrition. The five courses in the workshop series are based on the University of Northern Iowa Professional Teacher Standards and follow the design model employed by UNI in the development of over 30 online professional development courses. Key design elements included consistent web page design, thorough instructional design, and collaborative learning elements in combination with the active mentoring of an experienced faculty. Most importantly the mentoring and monitoring of student performance created an expectation of course completion and attrition rates have been held below six percent for over five years

Causative Analysis

Most of the studies in the distance education and adult education literature describe one of two different causes of the poor completion rates. One theory proposes that the withdrawals are mostly due to the life circumstances. Adult students who are attracted to distance education are older, more likely to be employed and married. These students who are juggling full time jobs and family responsibilities withdraw from classes to attend to other areas of their lives (Scalese, 2001). Under this approach dropping a course is seen as somewhat outside of the control of the university and therefore cannot be addressed through policy. Indeed in adult education students opting out and returning to coursework is seen as the more normal pattern. Adult students leave course work when their needs are met. Under this scenario dropping of a course should not be seen as a failure (Kerka, ; Tresman, 2002). The second most common explanation in the literature centers on the nature of distance education and blames the high attrition rates on the lack of social contact between the instructor and the students (Faust, 1999; Muirhead, 2000).

The literature supports the idea then that most often the decision to drop is outside of the scope of influence of the university. That is to say that most attrition will be impossible to prevent. Distance education can accommodate the role conflict that occurs for students by offering flexibility in course work when family and work balance issues occur, but under the first scenario this accommodation will not remedy the cause. Even if we accept prima facie that we cannot fully resolve the work-family-school balance problem, the difficulties of social isolation in distance education is a factor that can and should be mitigated if distance education is to thrive. The separation of the instructor and the learner is prima facie part of the definition of distance education. However this separation need not give rise to isolation (Keegan, 1996).

Workshop Design and Implementation to address Isolation

There are two important arenas in which to address this isolation; first is in the course design and later in the implementation of the instruction. Several design elements decrease isolation and thereby promote retention. Issues of individual enrollment and asynchronous vs. synchronous work must balance convenience against the promotion of retention. The workshops are group-paced rather than self paced. Following a modular approach and discouraging students from working ahead helps to cement the learning community. There is social support created as the groups progressed through the modules together. So while self-pacing is attractive to students there is a trade-off in lower social cohesion. Another issue in the design was the inclusion of synchronous activities. While research has shown synchronous communication to increase social cohesion the asynchronous design was a matter of practicality since UNI workshops typically enroll 12 to 18 students across four or more time zones.

Design must carefully support the implementation so one of the first tasks in the design of any of the UNI workshops is to fast track the formation of a learning community and promote collaboration among its members. The formation of a learning communities are seen as a hedge against withdrawals. The learning community is so key to online education that Palloff and Pratt are quoted as saying “The learning community is the vehicle through which learning occurs online." (Parloff & Pratt, 1999). In the UNI workshops the development of the learning community starts immediately with an icebreaker activity. This email-based activity is designed to draw attention to the common human bonds between the students.

One icebreaker question asks if they could be doing anything at this moment what would they be doing? Students are encouraged to respond to their classmates’ postings. Two approaches have been suggested as appropriate for the instructor in such a group. Instructor’s can hang back from participating and allow the group to form on its own (Jeong, 1996; Jordan, 1999) Alternately the instructor can participate as any other member of the group modeling icebreaker postings and commenting on common ground between students for example, if students are involved in the same curricular area (Piburn & Middletown, 1997; Seale & Cann, 2000). The UNI experience suggests that the involved instructor who models collaborative behavior is a key to retention. The instructor must set an empathetic tone and the expectation that this is to be a community. To this end the first few days of the workshop are purposefully and exclusively devoted to these activities.

Research suggests that online groups need to process through similar stages as face-to-face groups. Tuckman’s model of forming, storming, norming and performing has been postulated as applicable in the online world (Glover, 2003). Each stage demands an outlet within the learning community. Just as the icebreaker sets the expectation for forming inclusion of collaborative activities permit the group(s) to establish norms. One to two collaborative activities are included in each module of the workshops. For each of these assignments different partners are assigned so that by the end of the workshop the students have had a chance to work with all of their colleagues. The collaborative assignments are included as a significant portion of the student’s grade in order to builds accountability to the learning community. Once again the instructor sets the expectations for collaboration by explicitly directing the pairings, ensuring easy access to each other through a class roster and by listing alternate email addresses for students and setting interim deadlines. A module in the workshop may last 10 days but the instructor will ask for a progress report on the group project after four or five. Instructors may assign group leaders during the first module and thereafter leave it to the group to rotate the leadership. This would facilitate norming and performing. The expectation of checking in with your group members even if it is just to say "I haven't had time to read the assignment yet" is also explicit.

In the UNI experience groups do not seem to storm as such. Rather assignments are left to the last minute and approximately 20% of the time handed in as individual assignments due to a group member's non-responsiveness. When this occurs the instructor investigates in a curious, not furious way. The assumption is that some unavoidable life circumstance has interfered with the student's good intentions to complete the assignment. Students must be coached to also give the "benefit of the doubt" in this way. When a student has defaulted on their responsibility to the group the instructor gives quick feedback and monitors more closely to ensure this does not occur again. It is common to place the defaulting student in a leadership role for the next collaborative assignment. Often the burden of leadership creates the social pressure not to default in the future. The instructor also gives quick responses to the student who brought the defaulting to the instructor's attention. These responses always start with acknowledgement of the frustration and the difficulty and thank the student for having the courage to speak up. The offending student's confidentiality is maintained but the reporting student is informed that action has been taken. This is again respectful of the norms of the learning community that are based on individual responsibility.

Constructivist activities

The collaborative assignments are all based on applying theoretical principles to real world teaching scenarios. Students are all active practitioners involved in the classroom who can draw upon the wealth of their teaching experiences to illustrate various theoretical points. Each workshop includes the development of a unit of instruction. The assignments take a production-style approach to developing this unit so that a piece of it is assigned in each unit until the student has a finished lesson plan ready to be implemented and infused with technology. Student evaluations of the workshops highlight this design approach as a key factor in maintaining their interest in the course and their full participation. As with face-to-face adult students, online adult students want tangible problem solving skills that they can apply to their professional situations immediately.

The Relationship Between Instructor and Student

Assuming that the quality of social interaction is greater with experienced instructors and in keeping with the recommendations in the literature the quality and commitment of the instructors was recognized as a contributing factor in controlling withdrawals. Instructors with hundreds of hours of online experiencewere recruited and the timeliness of email responses was a discriminating factor in the selection process. More than one qualified instructor was not considered if emails sent on an "acquaintance basis" went unanswered.

A quick response via email was an indicator of a service mentality and an eagerness to engage in online interpersonal connections. Two components of service to students evolved during the instructional phase of these classes. First is the ability to do what Dirksen and Leggett (2002) refer to as cybernag and cyberschmooze (Dirksen & Leggett, 2002). A delicate balance between the two approaches must be achieved. Too much nagging and the student is alienated, too much social banter and the instructor's credibility can be called into question. Yet the social support from an instructor can be a key factor in a student completing the workshop. Instructors function in an advisory capacity on occasions when a student is considering dropping the workshop. A high level of service mentality is employed to accommodate the individual needs of the student while preserving the rigor of the coursework (Ainslie & Eves, 1998; Willis, 1992).

A Mentor and a Monitor

In addition to cultivating a socially supportive and instructional relationship with the students instructors take an active role in monitoring student progress. A few days after the conclusion of each module the instructor reviews an online grade book and monitors students who were missing assignments. Proactive emails and telephone calls are made to help students keep on track with their workload and to investigate any sources of confusion with respect to the material (Bennett, 1997). Other research has found this active phone approach effective. Towles found that 55% of the DE students in his study who receive a mentoring phone call successfully completed their course while 64% of those not called withdrew (Towles, 1993). Most often what these contacts revealed was some outside responsibility that was draining time away from course work. This anecdotal finding concurs with the literature that states that family/work responsibilities were most often the cause of dropping a course. Instructors in the UNI courses were given the authority to make individual accommodations. For example late submissions were accepted. In some cases minor assignments were made optional as a retention method.

Ultimately an instructional design was in place that supported the formation of a learning community and through its success, would promote retention. Implementing this relied on two principles first, that quick responses from the instructors would be essential. A 24-48 hour turn-around on student work was set as the standard. This was done to provide the students with timely feedback but also to combat the sense of isolation distance learners are documented as feeling.

Each instructor response would follow a praise/question/polish approach. First some specific praise for the submitted assignment would be detailed. Any areas in need of clarification or rewriting would be addressed in the form of a question rather than a statement of deficiency. Additions or minor improvements would then be suggested. This format was followed in order to ensure that positive feedback was the main emphasis of instructor/student contact. This kind of positive tenor would serve to motivate students. It was especially important to respond to low quality work in this framework. All submissions that fell below the standards of excellent as described in the grading rubrics were responded to following this coaching model. The students were then offered the chance to improve their grade by polishing the submission and resubmitting it. A kind of continuous quality improvement approach evolved and all work was considered a work in progress. Occasionally, students would even go back several modules and rework graded submissions based on new knowledge they had gained (Schoenfeld-Tacher & Persichitte, 2000).

One unique aspect of the instructor/student relationship in the UNI courses was seen in that the instructor focused on more than just grading the assignments. A secondary goal of the email exchanges was to start a dialogue with the student. This dialogue which was similar to the didactic conversation described by several researchers. (Dillon & Walsh, 1992; Holmberg, 1995). Dialogue was often based upon ideas that the student's submission had sparked in the instructor's thinking. These comments took the form of 'By the way' (BTW) additions to the main task at hand. Side conversations were generated and off-topic resources were shared frequently. One student for example, provided an in depth look at layered curriculum in response to a BTW comment from the instructor. On another occasion several students advised the instructor on a classroom management problem she was experiencing and in almost every class students debated the issue of class size as a barrier to active learning activities.

Student Feedback

Mid course and end of course comments consistently documents that students found the flexibility of online learning a key factor in their decision to enroll in a workshop and to complete it. When students made additional comments in an extensive summative evaluation of the workshop often they praised the timely response of the instructors. The Online programs at UNI involve web based readings, journaling, video reviews and collaborative projects. The success of the programs has been marked not only by the high completion rate but also be student and institutional reviews.

Conclusions

UNI Professional Teacher Competencies Workshops have maintained a stellar retention rate of less than 6% for more than five years. This is due to design and implementation elements in the courses. Instructors act as proactive, socially supportive mentors in that they model good online behavior, consistently offer 24 hour turn around on assignments, coach individual students in completing constructivist based group projects, assist groups in forming, norming, storming and set high expectations for group performance. Instructors actively monitor student progress and inquire immediately if deadlines are not met. These inquiries are couched in a professional, respectful tone that gives the student the "benefit of the doubt" in that the instructor assumes that students are committed to completing the workshop. The instructor's tone is collegial ensuring that students receive positively voiced feedback and peer support. "By the Way" commentary enhances the workshop and helps students to solve instructional problems in the real world.

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CSCL and Work-Based Activities in Multinational Corporate Settings

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Abstract

Business needs in multinational corporations call for learning outcomes that involve problem solutions and creating and sharing new knowledge within workplace situations that may involve participants in varying national settings. Computer-supported collaborative learning (CSCL) applied in courses that emphasize work-based activities is an appropriate tool for such learning situations. A theoretical model for WBA-CSCL (work-based activities and CSCL) is derived and from it elements of a pedagogical model are discussed. Finally, issues and challenges arising during implementation of the framework and the model are identified.

Introduction and Problem Statement

In the workplaces of professionals in multinational corporations problems and challenges continually arise that involve creating new solutions and constructing new knowledge, and indirectly involve improving communication and understanding among colleagues in different parts of the world, working virtually with one another. Key strategies involve capturing and sharing the tacit knowledge in the corporation, a particularly challenging task in that such knowledge is often difficult to see and express, is personal, and involves subjective perception, intuition, and foresight (Nonaka & Konno, 1999). Learning takes place in the context of these challenges and strategies. Such learning can be either formal such as via participation in structured courses, or informal, such as via mentoring and coaching in the workplace related to cognitive apprenticeship (Collins, Brown, & Newman, 1989); self-directed processes and experiential learning (Brookfield, 1995); and participation in "learning communities" (Wenger, 1998).

Both formal and informal approaches have their limitations as well as strengths. Among the strengths of structured learning are guided opportunities to learn while interacting with a new set of peers, broadening the learner's contacts beyond his or her workplace colleagues. Among the strengths of informal learning in the workplace is the anchoring of learning in problems and situations that are real and relevant to the learner (Billettt, 2001). Collaborative learning within courses that emphasize authentic work-based activities integrates both these sets of strengths and thus has strong applications in both formal and informal learning for professionals in the multinational corporate setting (Lim, Tan, & Klimas, 2001). In this paper we propose a form of formal learning emphasizing computer-supported collaborative learning applied to work-based activities and integrating the strengths of informal learning as a way to construct the new knowledge and new solutions necessary in the corporate setting.

The questions addressed in this paper are:

- Why is computer-supported collaborative learning (CSCL) involving work-based activities (WBA) an appropriate response to key needs in a multinational organization?
- What is a theoretical framework for WBA-CSCL in multinational corporate settings?
- What is a pedagogical model for concrete realizations of WBA-CSCL?
- What issues and challenges confront the realization in practice?

First, an analysis relating to the appropriateness of CSCL involving work-based activities for constructing new knowledge and creating solutions to business challenges is given. Then a theoretical framework for WBA-CSCL is proposed, derived from Gifford and Enyedy's "Activity Centered Design" (1999). Following this, the framework is used in defining a pedagogical model for WBA-CSCL. A discussion of implementation challenges and issues for further research based on the application of WBA-CSCL in courses at the Shell Open University concludes the paper.

Learning in a Multinational Corporation

This section addresses the question of why computer-supported collaborative learning involving work-based activities is an appropriate response to key needs in a multinational organization. The discussion focuses on the importance for corporate learning to be directly relevant to business and workplace needs and elaborates on the rationale for merging formal and informal forms of learning through courses where work-based activities involving collaborative learning are the focus. The need for a theoretical framework and a pedagogical model for this kind of learning will be highlighted.

Learning related to business needs

Organizational expectations related to corporate learning are focused on changes in performance that affect the business results. However, organizations often do not see a direct relationship between business results and their investments in formal corporate learning because much traditional formal learning is limited in its transfer to the daily workplace (Smith, 2002). Partly this is because formal courses too often focus on prepositional or conceptual knowledge ('knowledge that') and too little focus on procedural knowledge ('knowledge how') (Billettt, 2001). In contrast to knowledge transfer, corporate learning should be characterized by knowledge sharing, capturing experiences, reusing them, creating new knowledge, and recognizing and solving workplace problems, in a process-oriented, collaborative manner (for a literature review, see Collis & Margaryan, 2003). As an example, at a recent EAGE (European Association of Geoscientists and Engineers) conference, the petroleum industry's current needs were noted as including (a) the necessity for professionals to understand different disciplines rather than only their own discipline in isolation, (b) the development of teamwork, and (c) the necessity to understand evolving technology with a focus on the general principles of how a range of different technologies function rather than specifics of only a few types (Vedrenne, 2002). All of these call for meta-cognitive capabilities that are best fostered in collaborative learning situations focusing on work-based situations rather than courses characterized by knowledge transfer (Seufert & Seufert, 1999).

When supported by network technology, courses based on collaborative learning centered around real workplace problems and opportunities can create an environment where individuals and groups can jointly generate new ideas and get feedback on their own ideas from peers while working in complex learning situations in their own workplaces. The interactions can provide possibilities for individuals to articulate their own tacit knowledge and share it with others. Collaboration occurs in a variety of ways: among the course participants, within a team sharing the same workplace, or between teams with generically similar problems but different workplaces. Within the workplace, collaboration also involves one's peers and also one's supervisor and relevant others in the corporation. All these need to be integrated by the course instructor so that sharing occurs. This approach to CSCL involves the use of networked technology that includes groupware tools such as shared archives, and tools for structuring, monitoring, and motivating overall course processes. CSCL is facilitated by a "computer-based network system that supports group work in a common task and provides a shared interface for groups to work with" (Hsiao, 2003). CSCL can build upon the affordances of computer-supported systems that can support and facilitate group learning in ways that are not achievable in traditional classroom-learning environments (though CSCL should not necessarily replace face-to-face contacts).

This paper argues that an integration of formal and informal workplace learning via courses with work-based activities involving computer-supported collaboration as the integrating element is an appropriate way to address the business needs of a multinational corporation. Such an integration can be called WBA-CSCL (work-based activities and computer-support collaborative learning). First a theoretical framework is needed as a conceptual basis for such integration. In addition, a pedagogic model is important in order to operationalise the conceptual framework in practice. In the following section, a theoretical framework for WBA-CSCL will be discussed, and following that a pedagogical model based on that framework will be proposed.

Towards a Theoretical Framework for WBA-CSCL

In the first section, tthe social-cultural Activity Theory will be discussed as the basis for a theoretical framework for learning based on work-based activities and collaboration carried out in computer-supported collaborative learning (CSCL) environments. The key components of Activity Theory in relation to corporate learning will be elaborated in the following section and the WBA-CSCL Framework will be introduced.

Activity Theory and CSCL

Activity Theory (Leont'ev, 1978; Vygotsky, 1978, originally published in Russian in 1930) is being increasingly used to understand social aspects of technology-supported learning (see for example Jonassen, 2002). In the design of technology-supported learning in the corporate setting, social aspects of learning have often been neglected, with the design efforts primarily focused on either the content of the learning domain or profiling of the individual learner (Gifford & Enyedy, 1999; Russell, 2002). However, the social aspects of learning are particularly important in work-based learning focused on workplace practices and problems, the needs of the business, working with others, complex interdependencies, participation, and engagement (Billett, 2002).

Activity Theory can contribute to the understanding of computer-supported collaborative learning (CSCL) in the corporate setting by "[understanding] learning not as the internalization of discrete information or skills by individuals, but rather as expanding involvement over time – social as well as intellectual – with other people and the tools available in their culture" (Russell, 2002, p. 65). The key propositions of Activity Theory relevant for WBA-CSCL are that human activities are the unit of analysis, and they are always situated in a context or "an activity system" with seven main elements ("contextualized activity"; Engestroem, 1987, Kuutti, 1996, and Gifford and Enyedy, 1999) as shown in Figure 1:

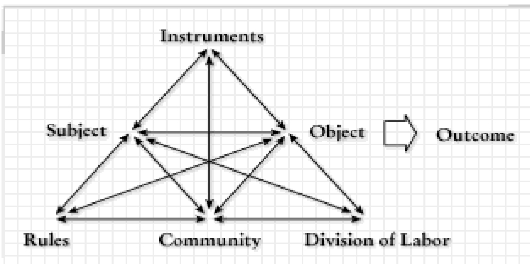

Figure 1. An activity system (Engestroem, 1987)

In Figure 1, the seven main concepts relate to:

1. Subject: The actors involved in the activity
2. Instruments: Tools, theories, and procedures that mediate the activity
3. Object: Products acted upon by the subjects during the activity
4. Community: Socio-cultural context in which the activity takes place
5. Rules: Implicit and explicit rules and norms of the community that constrain the activity
6. Division of Labor: Horizontal and vertical roles and relationships within the community that affect task division
7. Outcome: Transformation of the objects; the overall intention of the activity system (Jonassen, 2002).

The following section will discuss in more detail how Activity Theory can be adapted to to the particular type of corporate learning represented in WBA-CSCL.

The Work-Based Activities-CSCL Framework (WBA-CSCL)

An activity system for CSCL settings in courses involving work-based activities in multinational corporate settings as shown in Figure 2.

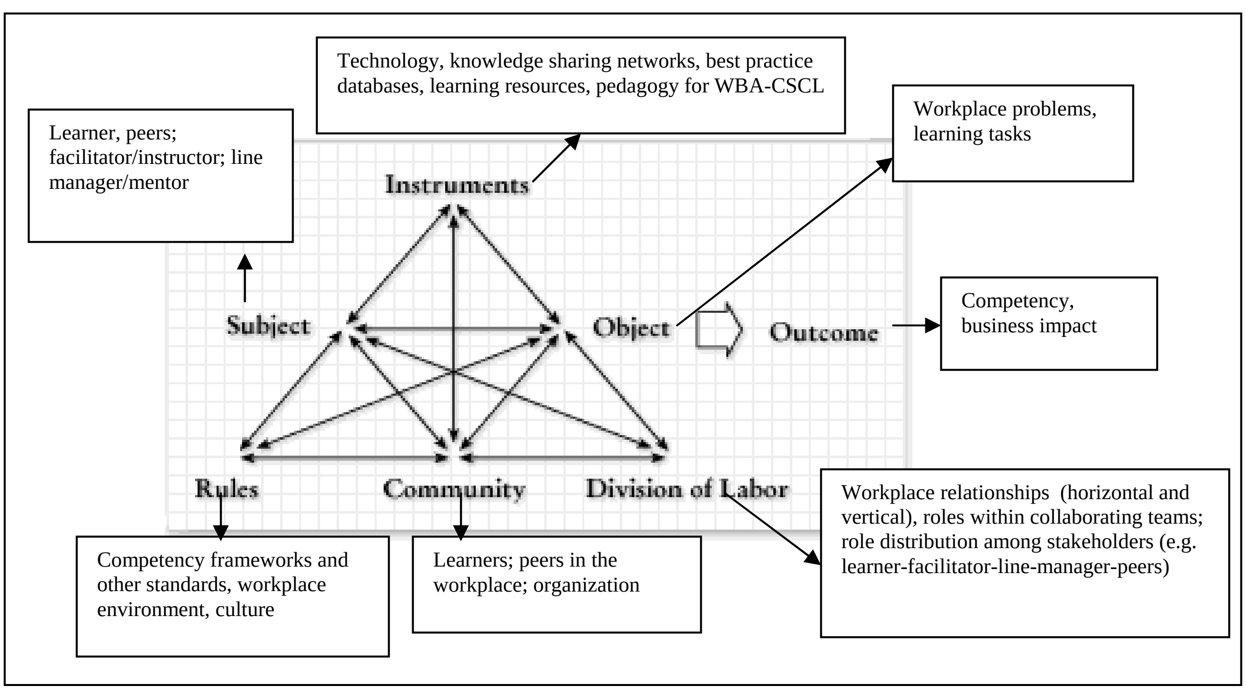

Figure 2. An activity system representation of WBA-CSCL in a multinational corporate setting

The elements can be described as follows:

Outcome: Business impact through (a) increased knowledge sharing particularly among colleagues in different locations and from different national cultures, (b) solutions to immediate problems in the workplace, and (c) competence development of individuals based on performance.

Objects: Workplace problems as learning tasks. Oliver and Herrington (2001) identify a variety of activities appropriate for task-based learning, including inquiry tasks, projects, and investigations (p. 31). What is critical in their view of tasks is that all involve authentic problems. Tasks are open-ended, not simple but reflecting the complexity of real-world settings, do not have a fixed solution, invite different solution approaches, stress collaboration among learners, and require learners to access a variety of information sources (pp. 32-33). Following Merrill's first-principle approach (2002), the tasks will be experienced as a series of (sub)tasks, beginning with tasks relating to gaining insight into the workplace problem or opportunity, moving into tasks that relate to planning a solution, then to tasks that relate to trying out the plans, and finally to tasks that relate to reflection. For each of these tasks, learners collaborate with each other in various ways, mediated by technology, and with scaffolding of support taking place, ideally moving from the course instructor or facilitator to the peers within the collaborative team and workplace supervisors.

Subjects: All involved in the activity system, including not only the course instructor(s) and the learners directly enrolled in the course, but also the "learning partners" (Bianco & Collis, 2003) of the learners in their workplaces, particularly their supervisors and workplace colleagues who will become involved in the learning activities.

Rules: In corporate settings, this is often the competency framework of the company as well as the formal and informal norms of behaviour.

Community: The broader corporate context. In multinational corporations this becomes complicated as it involves not only a corporate culture but also the cultures of the individual workplaces.

Division of Relationships: Workplace relationships affecting roles within collaborating teams and role distribution between learners, instructors, and the supervisors of learners. When multinational corporations are involved, there may be different expectations as to appropriate types of interactions among learners, instructors, and workplace supervisors related to different cultural backgrounds (Arya, Margaryan, & Collis, 2003).

Instruments: This element has at least four components: a pedagogical foundation, learning resources, learning supports, and online tools and environments.

Pedagogical foundation: In a recent synthesis of principles underlying instructional-design theories and models, Merrill (2002) has identified five key principles that he argues they have in common and thus represent a core basis for designing instruction. These are:

> "Learning is promoted when learners are engaged in solving real-world problems
> Learning is promoted when existing knowledge is activated as a foundation for new knowledge.
> Learning is promoted when new knowledge is demonstrated to the learner.
> Learning is promoted when new knowledge is applied by the learner.
> Learning is promoted when new knowledge is integrated into the learner's world." (Merrill, 2002, p. 44-45)

These principles are "relationships that are always taken to be true under appropriate conditions, regardless of program or practice" (p. 43), and thus also appropriate for WBA-CSCL. They are "design oriented and prescriptive"…and thus "relate to creating learning environments and products" (p. 44) and thus provide a basis for a concrete realization of WBA-CSCL. Each of the five principles has corollaries that provide a translation from principle to prescription. These are summarized in Table 1.

Table 1. *Prescriptions for instructional design, summarized from Merrill, 2002, pp. 44-51*

Principles and corollaries	Prescriptions
Principle 1: Problem setting Corollaries: Show task, task level, problem centered	-Engage learners in real-world problems that are engaging and relevant

	-Make clear the intended final behavior -Move in a progression from less-complex to more-complex tasks
Principle 2: Activation Corollaries: Previous experience, new experience, structure	-Apply past experiences to new problems, -Stimulate the development of mental models to bridge past experience with new problems
Principle 3: Demonstration (Show me) Corollaries: Consistency, learner guidance, relevant media	-Demonstrate information via specific examples or cases -Provide multiple representations -Guide the learner to focus on relevant aspects of the demonstration
Principle 4: Application (Let me) Corollaries: Practice consistency, diminishing coaching, varied practice	-Use new knowledge or skills to solve real-world problems -Scaffold the gradual withdrawal of support -Provide a variety of practice experiences
Principle 5: Integration (Watch me) Corollaries: Reflection, integration	-Synthesize and share -Create new insights and take into practice

Learning resources: A variety of different types of resources should be available to support a WBA-CSCL pedagogy (Van der Veen, 1991; Oliver & Herrington, 2001). Because of the authentic workplace setting, some of the resources will be from the workplace itself, such as documents and artifacts relevant to the learning task. In the case of a multinational corporation, where learners involved in a collaborative task can come from local branches of the corporation that are highly diverse in culture and workplace climates, it is important that resources relate to the local settings of the learners as well as the general setting of their parent corporation. The need to anticipate cultural differences by providing a diversity of types of resources, as well as diversity in task expectations, then become a major issue (Arya, Margaryan, & Collis, 2003).

Sources of learning resources can include: e-learning modules, manuals, help resources, and electronic performance support tools, digital capturing of in-house presentations or other artifacts from the workplace, resources available through the corporate knowledge management systems, such as discussion forums and best-practice repositories, professional reports located via the WWW or portals or conferences relevant to the domain of the problem. An important source of learning resources are the learners themselves, through the process of submitting the results of their various tasks into a shared electronic environment where they can be used and reused by others as learning resources. This "contribution-based pedagogy" is a key stimulus for learner-produced objects that can serve as learning objects for others (Collis & Moonen, 2001).

Learning supports: Oliver and Herrington (2001) describe learning supports as "the processes and procedures by which learners are assisted in their learning activities, by which feedback and guidance is provided to them, and by which their involvement in the learning setting is encouraged and strengthened" (p. 55). This definition includes persons involved in learning support, including those directly involved (the course instructor or facilitators) and those involved without a role that explicitly indicates their support. The latter, in WBA-CSCL, include the peer-collaborators, the workplace supervisors or coaches who become involved in the activities by their nature of being a real workplace task, and others throughout the corporation whose experiences may be found within in-house discussion groups and repositories of best practice or who can be contacted by the learners in relation to their workplace tasks.

Like Merrill (2002), Oliver and Herrington (2001) see collaborative learning and collaborative groups as learning support. They note factors that impact on the effectiveness of collaborative groups in terms of learning such as the extent to which the learners apportion tasks and carry out negotiation and synthesis. Van der Veen (2001) also identified a number of factors that constrain the effectiveness of collaborative problem solving, particularly when collaborators are at a distance from one another. He grouped these as operationalisation problems (for example, collaborators have problems organizing work between meetings, or accessing appropriate resources or problems arising to miscommunication); monitoring problems (such as facilitators lacking adequate insight into current learning activities); and planning problems (individual collaborators cannot keep to agreements about times for interactions and contributions). For each of these, support tools and strategies can help, particularly those available electronically. As collaboration in the context of work-based activities will be regularly challenged by planning, operationalisation, and monitoring problems, support for collaboration must be considered within the WBA-CSCL framework.

Online tools and environments: Electronic tools and environments are an integral component of CSCL, and therefore of the WBA-CSCL activity system. Networked tools and environments support the presentation of tasks and submission and feedback process associated with results of tasks. Shared environments provide the common medium for collaborative work, including for tasks related to planning, operationalisation, and monitoring. Tools and a shared environment are critical to a contribution-oriented approach to learning resources (Collis & Moonen, 2001). There are many categories of electronic tools for learning support for WBA-CSCL (Collis & Margaryan, 2003). These can include cognitive tools such as mind-mapping software or outlining software for problem or concept representation (Jonassen, 2003); calculators; modeling tools; tools to support brainstorming or note taking; and tools to support the scaffolding of learning (Winnips, 2001). As an example, Pramudya-Dharma (2003) has recently identified more than 70 open-source tools and systems available via the Web, which can support CSCL and work-based activities. The majority of the tools and systems in Pramudya-Dharma's compilation share aspects that can be said to scaffold learning, either explicitly, through devices such as prompts, or implicitly through the interactions (Jonassen, Peck, & Wilson, 1999; Winnips, 2001) that they make possible.

The WBA-CSCL Framework provides a framework for insights into learning as activity through "a form of sociocultural analysis that focuses on the activity system as the unit of analysis rather than the individual" (Jonassen, 2002). However, the translation of such a framework into the design of CSCL learning events and environments requires a further step. "There is still an enormous amount of research needed to develop our understanding of how the material, social, and mental worlds interpenetrate in mediated activity. Activity Theory begins to lay out some of the dimensions of this task, but it is not yet clear how to apply the insights of Activity Theory (rather than merely critique) of Computer Supported Learning Environments" (Gifford & Enyedi, 1999). To move the WBA-CSCL Framework from a descriptive system to a tool for realization, the "Instrument" component of WBA-CSCL must be translated into concrete terms. This involves operationalising a pedagogical model for WBA-CSCL. The next section will outline the steps of such a model and a methodology for practice.

From Theoretical Framework to Pedagogical Steps

In this section, a methodology to put the elements into operational steps is presented as guidelines for a WBA-CSCL pedagogical approach.

The term "pedagogical model" is used in a variety of ways in the literature and practice but generally integrates aims, content, learning activities, and methodology within an underlying set of principles relating to learning or instructional design. (Grimmitt, 2003). Combining all the elements in the WBA-CSCL activity system discussed in the previous section, pedagogy to realize the WBA-CSCL in corporate practice can be expressed in a series of steps. The steps are divided into two parts, one for the design and preparation of a course including WBA-CSCL (Bianco, Collis, Cooke, & Margaryan, 2002; Merrill, 2002) and the other for facilitating the course in operation (Margaryan, Collis, & Cooke, 2003a,b).

Design of a course involving WBA-CSCL:

1. Identify in general terms the business needs and workplace problems that will form the setting for the course. From these, identify the general types of outcomes, the general types of work-based activities that are likely to be most related to the needs and problems, the forms of collaboration most likely to lead to the outcomes, and key concepts, skills, and knowledge related to the business needs and workplace problems.
2. Decide on the high-level organization of the course: When might face-to-face sessions be desirable? How and when should the supervisors of the participants be involved?
3. In more detail than Step 1, plan a series of tasks related to the overall work-based activity; for each task, identify what is expected, how the collaborating group should be working, when and how sharing with other groups will occur, and what learning resources and learning support are most likely to be relevant. Plan the contact and reporting moments within and among collaborating group. Plan the contact moments with the supervisors to engage them in the work-based activities.
4. Select the electronic tools for CSCL support; design and set up the electronic environments that will support course processes.
5. Advertise the course, make contacts with prospective learners and their supervisors explaining the WBA-CSCL aspects of the course, require all that wish to further continue to submit a "learning agreement" in

which the particular workplace needs and problems of the participants are indicated in detail and work-based activities that will be relevant in the workplace are identified.

6. Retune the course planning, based on the knowledge of the specific workplace situations that will form the context for the WBA-CSCL that is obtained from the learning agreements. Refine descriptions of (sub)tasks, refine identification and selection of appropriate learning resources, refine plans for learning support.
7. Elaborate the specific planning and support in the electronic course environment. Inform participants of the kick-off event for the course.

WBA-CSCL in practice

There is no single set of steps for how a course involving WBA-CSCL may be experienced in practice. Sometimes a face-to-face session will occur first, in order to orient the participants and cover some necessary preparation. Othertimes these aspects will occur on-line. Sometimes there will be no face-to-face setting for the course participants as a whole, other times there will be. The following however are generic steps, which should occur regardless of the approach chosen for course execution (adapted from Bianco, Collis, Cooke, & Margaryan, 2002; Collis & Moonen, 2001; Hendriks, 2003):

1. As the course is in operation, use the common electronic environment as support for each (sub)task. Participants can submit something that is subsequently (a) built upon for their own problem situation, (b) used by the other groups for peer sharing and interaction; and (c) is potentially available for reuse outside of the course context.
2. For each submission, give feedback, from the course facilitators or via peers or other groups of experts. Make this feedback always available via the course Web environment.
3. Check regularly with supervisors and engage them as "learning partners" (Bianco & Collis, 2003)
4. Conclude the course with systematic reflection about the WBA-CSCL that has occurred and its relation to business needs as well as individual and group professional development. Integrate evaluation input from all major subjects (actors).
5. Adapt the course accordingly for the following cycle

This approach has been in realization in the past 18 months at the Shell Open University (now part of the Learning and Leadership Development Unit of Shell International Exploration and Production, LLD-SIEP) in collaboration with researchers from the University of Twente (for full reports see Arya, Margaryan, & Collis, 2003; Bianco & Collis, 2003; Bianco, Collis, Cooke, & Margaryan, 2002; Hendriks, 2003; Margaryan, Collis, & Cooke, 2003a,b; Collis & Margaryan, 2003). As of September 2003, 96 courses have been redesigned to reflect the above methodology, although as yet not every course includes every step. In a detailed assessment of 36 of the courses (Collis, Margaryan, & Cooke, 2003a,b) instructions for 299 different work-based activities were found in the course Web environments. Evaluation has shown a consistently high valuation for the approach, by learners, instructors, and supervisors, although a common concern is that such an approach requires more time and effort than previous knowledge-transfer courses. Thus a start has been made, but research continues to be necessary. The experience that has been gathered at Shell has identified challenges that are the focus of on-going research.

Challenges and Future Research

The on-going research at the Shell EP Learning Centre confirms the expectation that moving to a new learning approach that integrates formal and informal learning around the framework of work-based activities and computer-supported collaborative learning is a complex process, but given a sound theoretical framework and a practical pedagogical model and course-redesign approach, scaling up into real practice can occur. Many issues remain challenging. These include: Organizational issues, time and workplace issues, issues relating to the involvement of the supervisor of the learner, and issues relating to the multinational setting. Each of these will be discussed briefly here.

Organizational and social issues

Major problems confronting the move to WBA-CSCL relate to the expectations in the workplace of what constitutes "learning". Learning is still seen, and accredited, around time spent "at courses". The concept of learning as going away to a course is strongly embedded not only in the expectations of all in the organization but also in the procedures used to describe and fund formal learning (how many people x how many hours in the classroom). Informal learning, or learning that goes on while still doing one's job, is not yet part of the formal system of recognizing learning in terms of promotions and career ladders although at Shell EP is being accepted as part of the new learning strategy adopted by the company in 2003. However, despite a statement of corporate strategy, support in terms of released time and learning facilitation is not yet in place when learning takes place within the context of real work in the learning setting. This places WBA-CSCL in a fringe or periphery position in terms of support and internal recognition.

Time and workplace issues

The strength of WBA-CSCL is that it is grounded in real workplace tasks. But this also contributes to the problem of how to build in the time needed for collaborative learning above simply "doing the job". The result is often that the learner has to fit in any collaborative-learning activities, particularly those relating to sharing, peer interaction and reflection, into his own time outside of the workplace. While many may be motivated enough by the benefits of learning from colleagues and being guided through elements such as reflection, many more will just not have the time to do more than their regular job. The close boundary between WBA-CSCL and learning is not only its strength but also its vulnerability in practice.

Issues relating to the involvement of the supervisor

The supervisor of the learner involved in WBA-CSCL must be supportive and should be more than only supportive, but also involved in the learning processes (Bianco & Collis, 2003). In practice, this step is difficult to achieve. Supervisors see "learning" as "going away to courses" and do not see that they have any further involvement. Many different strategies are being attempted, but without building support for WBA-CSCL into their job descriptions, the effort to effectively involve supervisors is an uphill battle.

Issues relating to the multinational setting

As the research has already shown, there are many complexities involved with striving for effective collaborative learning when the collaborators are distributed among different parts of the world and represent different cultural backgrounds. One approach is that of assuming homogeneity: in a multinational company, the course instructor might expect that all the learners will benefit from being treated as fitting a single "company culture". However, differences among people will still remain, and a more-productive approach will be to leverage cultural differences. How to realize this and make it manageable within a pedagogical model is a major challenge.

Thus, the WBA-CSCL Framework and its pedagogical realization appear to help in structuring the introduction of new forms of learning for professionals in multinational corporations. However, much research needs to be done, and much needs to change in the social climate of the workplace before the potential of the approach will be realized in daily practice.

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Practices and Academic Preparation of Instructional Designers

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The field of Instructional Design is relatively young–just over 50 years old according to some researchers. As is common in immature fields, Instructional Design has struggled to define itself. Definitions and theory were first derived from other disciplines, including Psychology, Computer Science, Statistics, and Education. While these disciplines continue to influence Instructional Design, the field is beginning to develop its own sense of purpose and scope.

Over the 50 years of its existence, many researchers have attempted to define Instructional Design. These definitions have been useful in guiding the fledgling field, but many are not informed by a careful examination of practice. Most have been very general definitions ranging from descriptions of practitioners' positions with respect to the use of hardware and software to the intangible theoretical bases for the field. In fact, even deciding on a name for the field has been a difficult challenge. I used the title of Instructional Design in this study because I examined the practice of instructional designers and the instructional design process. According to Reiser, the practice of instructional design is composed of two parts: first, "the use of media for instructional purposes," and second, "the use of systematic instructional design procedures" (2001). Seels and Richey define Instructional [Design] as "the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning" (1994). While these definitions are succinct, they do not reveal a full understanding of an instructional designer's responsibilities in the workplace.

As the field has matured and evolved, more attempts have been made to allow the theory and the practice of the field to interact with and inform one another. This is evidenced by the competencies for instructional designers (Richey, 2001) and the standards for academic programs (Earle, 2000) that have been developed as well as recent studies examining job descriptions in Instructional Design. For example, in an attempt to identify specific skills needed by designers, a study was conducted to determine the instructional design competencies that are most often requested by instructional design employers (Byun, 2000). This five-year study described 93 competencies that were then clustered into 33 relatively general skill categories (i.e., management, leadership, instructional design and development, etc.). While the information provided in this study is certainly useful and fulfills its purpose of informing academic departments of the most sought-after skills, it does not reveal what is actually being practiced once an individual is hired.

Theories in the field have also not generally been derived from professional practice (Reigeluth, 1999). While academic researchers may possess a vision of Instructional Design as a discipline, practitioners are comparatively unaware and uninformed of the purpose and direction of their field (Gibbons, 2000). Perhaps the best way to define the functions and parameters of a field is to observe the daily responsibilities of its practitioners (Stolovitch, 1995). Such studies have been conducted in many fields, including accounting (Pearson, 1991), medical education (Morrison, 2000), and teacher education (Adelman, 1998; Stark, 1985). Studies of this nature reveal the specific tasks and responsibilities performed by practitioners in each field. However, similar studies have not been conducted in Instructional Design in the recent past. While some research was conducted related to this topic in the early 1990's (G. Rowland, 1992; Wedman, 1993; Winer, 1995), these pre-Internet studies do not paint an accurate picture of current practice and many were conducted using a very small sample of designers. In recent years, studies in this field have relied on practitioners' and employers' perceptions of important skills and knowledge and not on actual reports by designers themselves of their daily practice. There seems to be an incongruity between academia and practice as institutions continue to teach theories, models, and concepts that may or may not be relevant in the professional world. While job descriptions and competencies may list these theories, models, and concepts as essential in the workplace, the practitioners themselves have not yet confirmed that such theories and models actually guide their practice.

Questions raised by an initial study I conducted in 2002 (Cox, 2003) clarified the need for further study of the instructional design profession. What, exactly, do instructional designers do? Which tasks are required of them regularly and which do they seldom engage in? How much of their time is spent in meetings and other organizational tasks and how much is spent actually designing instruction?

Determining how designers spend their time yields another very important question: are academic programs adequately teaching designers the skills they most often use? Job descriptions in the field typically include requests for applicants to possess advanced academic degrees (Byun, 2000). Yet it has not yet been determined if the designers themselves feel that Instructional Design graduate programs are preparing them for the job market. Curriculum may emphasize learning theories or ISD models but lack programming courses or other technical curriculum that is useful in practice. Because of this, graduates may leave their institutions feeling unsure of their skills or prospects for employment.

In this study I attempted to identify those tasks that professional instructional designers perform every day and the perceived value of advanced degree programs in preparing them to perform those tasks. This close examination of the practice of the discipline not only begins to reveal the scope of Instructional Design as a profession but will also inform those who offer academic programs as they work to prepare students for the job market. The study also reveals subtle differences in responsibilities based on workplace and experience. Finally, it identifies areas in which academic preparation may be lacking and suggests ways in which programs might improve or change their curriculum to meet practitioner needs. This information will be framed in the context of the recently adopted standards for programs in educational communications and instructional technologies (ECIT).

Research Questions

This study centers on the following research questions:

1. How do instructional designers spend their professional time?
2. How well do instructional designers feel their graduate programs prepared them for their assigned responsibilities?

I was also interested in studying the differences in how designers spend their time based on workplace, level of experience, and level of education and how the highest academic degree earned might be associated with differences in feelings of preparation.

Method

Sample

The first step in conducting this survey was to define the population to be examined. Because one of the major research questions sought to identify the level of preparation of practitioners who have graduated from formal Instructional Design programs, only alumni of such programs were contacted for participation. Acquiring the alumni lists proved to be the greatest challenge in completing the study as each university had a different policy with regard to their distribution. While some were allowed to release their lists directly to me, others offered to send the survey invitation themselves in order to protect their graduates. Some universities were unable to participate for various reasons (i.e., too busy, restricted access to alumni lists, etc.). This limited the scope of the study to the following institutions: Brigham Young University, Utah State University, University of Indiana, University of Georgia, Syracuse University, Florida State University, Pennsylvania State University, and San Diego State University. While this is not a long list, these institutions are among the most widely recognized programs in the field.

It should be noted here that the group that participated in this study is a subpopulation of the whole. As I stated earlier, the field of instructional design is in flux and searching for direction. By focusing on some of the better-known graduate programs in the field, I hoped to be able to paint a picture of what the leading programs are accomplishing and where we might be headed. For this reason, the results of the study may not be representative of what is happening at all institutions or with all instructional designers.

Further, I decided to limit the sample to full-time practicing instructional designers in order to make the scope of the study more manageable.

Instrumentation

Because technical proficiency is considered to be a mandatory skill in Instructional Design (Dillon, 2001), it was reasonable to assume that the target population would have access to and familiarity with the required technology to receive and complete an online survey. A link to the survey, along with a brief description of its purpose, was sent to each alumnus via email. Individuals who did not provide an email address to their institutions were not contacted for participation. I was able to contact alumni from Brigham Young University, Utah State University, and Florida State University directly, which enabled me to obtain an accurate response rate for these institutions only. All other alumni were contacted through a generic message sent by a representative at their universities.

After passing through a password page, consent form, and demographic questions, prospective participants were asked a qualifying question regarding current employment status. Only those who said they were working full-time as instructional designers could participate in the study. This measure was intended to insure that the survey data would not be corrupted by graduates who have pursued careers in which their primary function is not instructional design. This qualifying question also provided a more accurate survey response rate by allowing all alumni to begin the survey.

The survey itself began with some basic demographic questions including job title, employer type, academic degrees earned, and years of experience. Participants were then asked to indicate the percentage of their professional time spent in instructional design tasks and organizational tasks. Next, they were asked to indicate what percentage of their instructional design time was spent in various capacities including analysis, design, development, implementation, and evaluation (ADDIE). While there are many existing ISD models that might have been used to organize the tasks, the ADDIE model stands as the most widely accepted and is the basis for many other models (Rosenberg, 1999). It is noted that some consider the ADDIE model to be too restrictive and a few participants indicated that it was difficult to fit their responsibilities into those limited categories. Because of the very small number of comments in this area, I believe that the broad nature of the categories and the further definition of tasks in subsequent questions alleviated much of the discomfort over the use of the ADDIE model.

Organizational time was divided into responsibilities such as project management, personnel supervision, marketing, research, and professional development. Participants were then presented with a more detailed list of both design and organizational tasks and asked to identify how often they perform each task in their job and how well they feel their graduate programs prepared them for those duties. Both frequency and preparedness were measured on a rating scale in order to reduce the cognitive load on participants. Pilot tests revealed that attempting to assign percentages to each of the individual tasks was overwhelming for respondents. These detailed tasks were derived from a number of sources including Seels & Richey's (1994)*Instructional Technology: Definition and Domains of the Field*, the results of the initial study that I conducted, and interviews and pilot tests with practicing designers. The final section of the survey consisted of affective questions regarding the participants' academic preparation and the adequacy of their training.

Analysis

I used t-tests to compare the means of different groups for those questions in which participants were asked to assign a percentage of their time to different tasks. I created cross-tabulation tables and calculated chi-square tests on those questions that involved rating a variable on a provided scale. Cross-tabulation of variables was performed to determine if different groupings had an impact on how often various tasks were performed, how well prepared participants felt to perform those tasks, and how confident respondents felt in their ability to perform their responsibilities overall. Chi-square tests and t-tests were calculated for the following groupings: workplace, level of experience, highest degree earned, and school attended.

Results

Response Rate

As mentioned earlier, only alumni of Brigham Young University, Utah State University, and Florida State University were contacted directly. All other participants were contacted by a representative of the university from which they graduated through a generic email. For this reason, an accurate response rate can be determined only for BYU, USU, and FSU. The response rate for these institutions, after accounting for undeliverable mailings, was 63%. This compares favorably with rates typically seen in traditional surveys (Heberlein & Baumgartner, 1978, as cited in Kiesler, 1986).

Demographic Information

Of the total number of respondents, 56% indicated that they are currently employed full-time in an instructional design capacity. As mentioned above, this question was open to some interpretation and, therefore, the following results may include data from some individuals who are not necessarily instructional designers according to the definition given earlier. Some participants indicated through comments in the survey that they were employed in educational technology or administrative positions, but responded positively to the screening question. As it is impossible to determine if other participants did the same, the results of these participants were included in the final analysis. We are only able to conjecture how the remaining 44% are employed. This ambiguity suggests that, in future studies, participants be allowed to select a position title rather than answer a yes/no question regarding employment to gain a more descriptive picture of this demographic. An earlier, informal study that I conducted suggests that those not employed as instructional designers are faculty, administrators, instructional developers, project managers, teachers/trainers, or students. Others may have left full-time employment for retirement, part-time employment, or family or other responsibilities.

Among those currently employed in instructional design, the vast majority are employed in higher education (38%) or a large business setting (30%). “Large business” is defined here as a business with over 500 employees (Small Business Administration website). Other categories include smaller businesses (9%), self-employment (7%), K-12 schools (5%) and the government and military (5%). Because there were so few respondents in some of the employment categories, they were collapsed into four groups: Academics, Government, Small Business, and Large Business.

Survey participants ranged in experience from 0-40 years. This range was collapsed into the following categories: 0-1 years, 2-5 years, 6-10 years, 11-20 years, and more than 20 years of experience. The average amount of experience for all participants was nine years. One preceding study identified experts as those with at least seven years of experience (G. Rowland, 1992). Just over half of our sample has less than seven years of experience in instructional design. This data indicates a relatively young work force.

Research Question 1: How do instructional designers spend their professional time?

How do instructional designers spend their time? Respondents indicated that, on average, 53% of their professional time is spent in organizational tasks while 47% was spent performing instructional design tasks. These numbers may result from my definition of the task categories. Organizational tasks included project management, supervising personnel, professional meetings, academic research, marketing/sales, and professional development. Some may argue that any of these categories might be considered part of the instructional design process. The decision was made, however, to limit the instructional design tasks to those encompassed by the ADDIE model–analysis, design, development, implementation, and evaluation. Participants were then asked to divide their instructional design and organizational time into more specific task categories.

When asked to divide their instructional design time by task category (analysis, design, development, implementation, or evaluation), development received 29% of the time distribution with design at 21%. These were followed by analysis, implementation, and evaluation (See Figure 1).

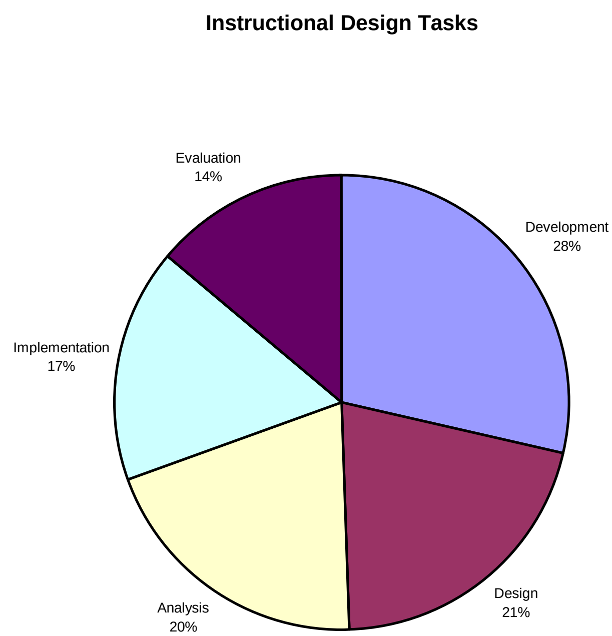

Figure 1. Distribution of instructional design time by category.

Each task category was divided into individual tasks that respondents rated according to the frequency with which they performed the task. The instructional design task most often performed involved writing and editing instructional materials (mean = 3.03 out of 4.0). The task least often performed was programming at 2.0. See Figure 2.

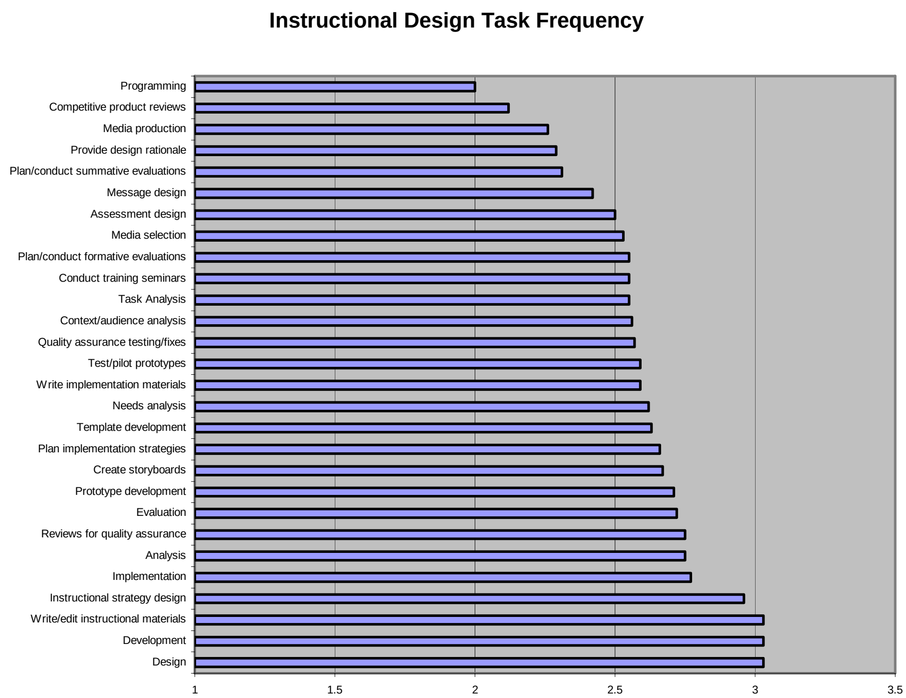

Figure 2. Average frequency ratings for all instructional design tasks.

When asked to divide their organizational time by task category (project management, supervising personnel, professional meetings, academic research, marketing/sales, or professional development), project management and professional meetings consumed the majority of respondents' time: 28% and 24%, respectively. These were followed by supervising personnel, academic research, marketing/sales, and professional development (See Figure 3).

Figure 3. Distribution of organizational time by category.

As was done with instructional design, the organizational task categories were divided into individual tasks. The organizational task most often performed involved reporting to and interacting with supervisors–a task in the "professional meetings" category. In fact, all tasks within this category were rated above a 3.0 (often). The least performed task was making marketing presentations at conferences (1.73 on the 4-point scale). See Figure 4.

I was also interested to see how various factors influence the ways in which designers spend their time. Results were analyzed based on workplace, level of experience, and level of education. Using t-tests, no significant differences were found in the overall division of participants' time between instructional design and organizational tasks, but chi-square tests reveal that the frequency with which specific functions are performed does seem to be associated with these factors.

Designers who work for small businesses tend to spend significantly less time designing assessments than any other group. While budgeting tasks are not frequently performed by any group, instructional designers in large businesses spend much less time performing this function than any other group—over 50% indicated that they never create budgets. Not surprisingly, those in academic positions (K-12 or College/University) engage in research activities including designing, conducting, and publishing research significantly more often than their business and government counterparts. This group also attends professional conferences more often than all other groups.

Level of experience is also associated with the frequency with which designers engage in individual tasks such as selecting instructional strategies and programming. Senior designers participate more often in the selection of strategies while newer designers are more involved in programming tasks.

Respondents with doctoral degrees tend to spend more time researching and providing rationale for design while Master's degree holders participate more often in storyboarding. Those with doctoral degrees also spend more time in evaluation tasks, particularly formative evaluation. Master's program graduates supervise personnel more often and meet more often with cross-functional co-workers (e.g., technical, quality assurance, marketing, or sales). Not surprisingly, those with doctoral degrees participate more often in tasks that involve research, including designing research, reading scholarly publications, and writing articles. They also attend professional conferences more frequently.

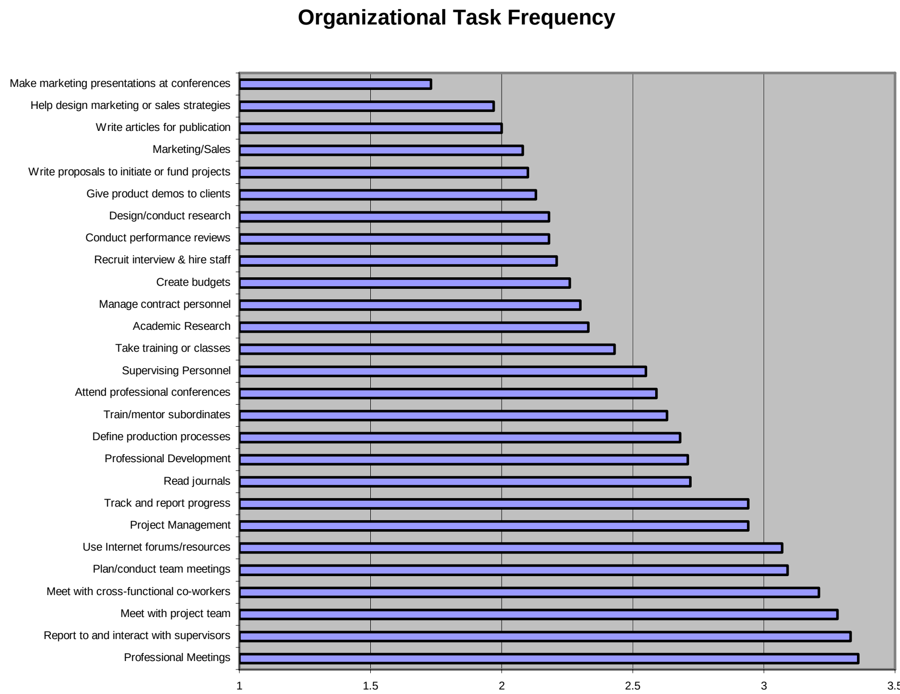

Figure 4. Average frequency ratings for all organizational tasks.

Research Question 2: How well do instructional designers feel their graduate programs prepared them for their assigned responsibilities?

Survey respondents indicated that they felt fairly well prepared by their graduate studies for their instructional design duties, with an average score of just over 3.0 on a 4-point scale (1 = very poorly, 2 = poorly, 3 = fairly well, or 4 = extremely well prepared). As shown in Figure 5, they felt most prepared for duties involving instructional strategy design (3.63) and least prepared for programming tasks (2.34).

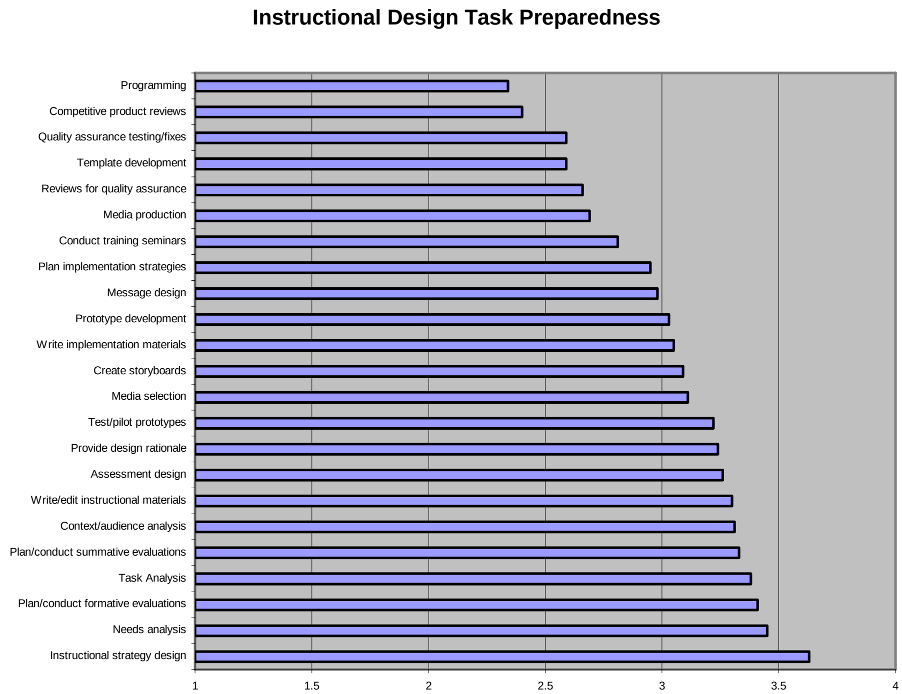

Figure 5. Average preparedness ratings for all instructional design tasks.

Survey participants indicated that they felt slightly less prepared overall to perform their organizational duties. The average preparedness rating for organizational tasks was 2.6 on our 4-point scale. As shown in Figure 6, the task for which they felt most prepared was academic research involving reading journals and trade books for research purposes (3.47). Participants felt least prepared to recruit, interview, and hire staff (1.82). In fact, three of the four tasks within the category of "supervising personnel" received mean ratings below a 2.0 on this scale.

There is a weak positive correlation between task frequency and task preparedness ($r = 0.51$ for instructional design tasks, $r = 0.40$ for organizational tasks), suggesting that, to some degree, graduate programs are emphasizing the most often performed tasks. For example, while respondents indicated that programming is the instructional design task for which they feel least prepared, they also indicated that it is the least often performed design task. At the other end, participants chose instructional strategy design as the task for which they feel best prepared. This task is also the second most frequently performed.

I was interested to see how level of education influenced feelings of preparedness in the survey respondents. In this survey, those with Master's degrees feel better prepared to conduct a needs analysis, while doctoral graduates are more comfortable in all of the research-related tasks. Doctoral degree holders are also somewhat better prepared to take professional development classes.

For what responsibilities do they feel best prepared?

When asked to select the one task for which they felt best prepared by their graduate studies in the instructional design tasks category, 29% of participants chose instructional strategy design. An additional 17% selected needs analysis and 15% picked researching and providing theoretical rational for their design as the task for which they were best prepared. The remaining responses were distributed among a variety of choices. It is interesting to note that no one chose performing competitive product reviews, writing implementation materials, or piloting prototypes as their best task.

In the organizational tasks category, 18% of the participants said that they were best prepared to design and conduct research. An additional 17% selected meeting with project teams. The remaining responses were distributed among a variety of choices. None of the respondents indicated that they were best prepared to conduct performance reviews or make marketing presentations at conferences.

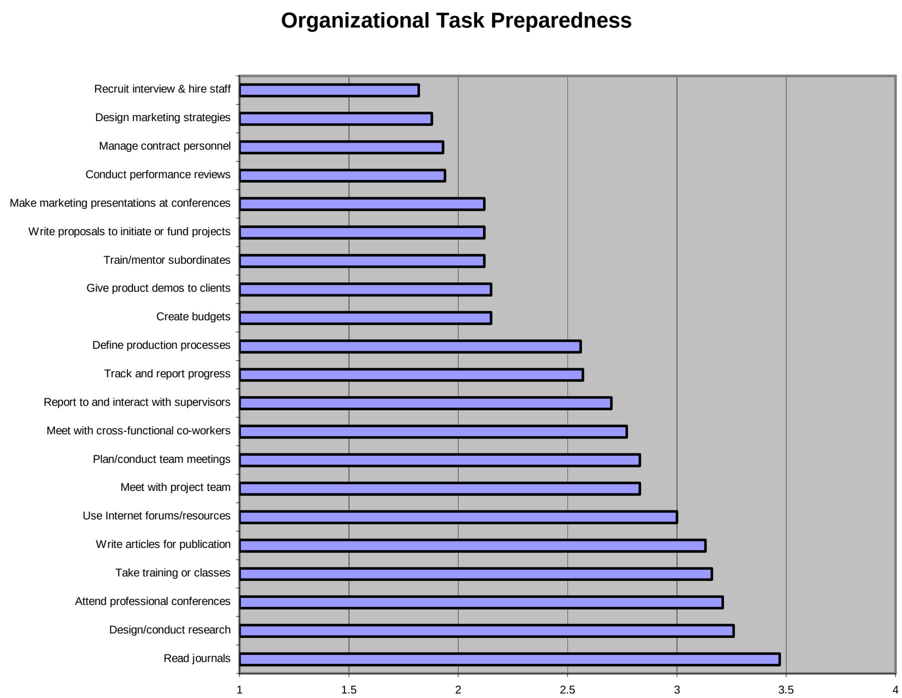

Figure 6. Average preparedness ratings for all organizational tasks.

For what responsibilities do they feel least prepared?

In the instructional design tasks category, 24% of participants chose programming as the task for which they were least prepared, 21% selected competitive product reviews, and 10% picked media production. No one indicated that they felt least prepared to write or edit instructional materials, plan implementation strategies and training, or plan and conduct formative evaluations.

Budgeting was selected most often as the organizational task for which respondents were least prepared (24%). Additionally, 19% selected tasks involving recruiting and hiring staff, 11% chose working with contract personnel, and 10% picked designing marketing strategies. None of the survey respondents chose meeting with the project team, planning those team meetings, or reading journals for research purposes as the task for which they felt least prepared.

Discussion and Conclusions

How do instructional designers spend their time? Those in this study spend a slight majority of their time participating in organizational activities. Their instructional design time is spent largely in designing and developing instruction. While, on average, they engage in all of the steps in the ADDIE model of instructional design, none of the phases of the model are performed very often by the group. They most frequently participate in instructional design tasks that involve writing and editing instructional materials and instructional strategy design. The most frequently performed organizational tasks involve meetings and project management.

The participants in this study feel fairly well prepared to engage in the tasks required of them, but there is room for improvement. One question in the survey asked participants what they would change about their graduate studies. Three comments were prevalent: (a) more business/organizational training, (b) more technical training, and (c) more real-world application in the form of teamwork, consulting, internships, and existing product reviews. Interestingly, these comments are directly aligned with changes suggested by at least one earlier researcher (Quinn, 1994). More than one respondent suggested that instructors attempt to create a level of unification between classes so that students are able to make connections and supervise projects through the entire process. Another participant made a very frank comment that, I believe, holds great potential for program improvement. He said:

"For heaven's sake, give us some decent project management classes. Help to learn to make budgets and follow them. Teach us to work in teams. Help us to estimate costs. On the ID side, we need more projects that are in a real setting as part of our class. We also need more projects that we step through the entire design process on. It would be great if we could set up a situation where local community entities with instructional needs could get a team of students to meet their needs. You can't substitute for real experience in a real setting. Also, bring in the practitioners, not just for lectures but to critique project plans or project results. I could have learned a lot from some professional eyes looking at my student work."

In short, practicing designers want their academic programs to more closely mirror the experience of being a designer in the real world.

Again, the participants in this survey were all graduates of some of the more prominent academic programs in the field, and all have received an advanced degree in instructional design. While this distinction may cause the results of this study to be less representative of the larger population of instructional designers and institutions, it is reasonable to assume that these programs will serve as models for newer departments in the field. For this reason, I believe that a study of these institutions and their graduates helps to paint a picture of the present and future of our field.

While the graduate programs in this study do a fairly good job of preparing instructional designers for employment, there seem to be some areas in which improvement could be made. First, an increased emphasis in business skills may be valuable. Second, administrators of Master's degree programs in particular may benefit their students by emphasizing proficiency in development and production skills including programming, storyboarding, prototyping, etc. Third, administrators should put forth more effort in informing students of the differences between job environments so that graduates are better able to make employment decisions. Potential students may also want to examine the emphasis of each program they are considering in order to select the one that is most in line with their career goals. Another consideration may be the efficacy of undergraduate programs in the field. Approximately 67% of those surveyed felt that an undergraduate degree would adequately prepare individuals for an instructional design position.

Finally, degree programs must offer more than in-class instruction and research projects. An interesting comment made by two respondents involved the nature of their graduate experience. They answered the survey questions according to their graduate coursework, as instructed, but mentioned that other experiences, including internships and faculty mentoring, prepared them for future employment much better than their coursework did. Other researchers (Ertmer, 1995; Quinn, 1994; Rowland, 1994; Tripp, 1994) agree that providing instructional design students with practical experience in the form of internships, apprenticeships, class projects, or design studios may be the best way to prepare them for the workforce.

The above recommendations are not new. Though similar suggestions for improvement were made nearly a decade ago (Quinn, 1994), it would appear that none of them have been widely implemented. It is time that program administrators listen to their graduates and the practitioners of the discipline and make the necessary changes so that instructional design alumni can be better prepared to fulfill their responsibilities.

Suggestions for future research

This study has introduced a number of questions that I feel should be addressed in future research. The first involves the various capacities in which graduates of instructional design programs are employed. My second suggestion is a more in-depth examination of designer practice including case studies of individual designers employed by various institutions. A third potential research topic is the curricular offerings of academic programs in the field and how they compare to the ECIT standards. Finally, I believe that an examination of the existence and composition of instructional design teams would be beneficial to the field.

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Developing A Web Portal: The Technology Behind The Screen

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Abstract

Network based education systems are important in this technologically advanced era. ALEX, one such system, is proposed in this paper as a web portal for Alabama teachers. The ALEX system includes lesson plans, web resources, communication tools, and a wealth of other educational materials for teachers. HTML, PHP, PERL, and MySQL were used to develop this system; appropriately, it is deployed on the Internet making it available to all Alabama educators regardless of geographic location or economic status.

Introduction

The Alabama Learning Exchange (ALEX), http://www.alex.state.al.us, is a network based education system that was designed to help improve education in the state of Alabama. The ALEX system provides one location for Alabama K-12 educators to find information that will help improve their effectiveness in the classroom. It includes courses of study content standards, lesson plans, web resources, listservs, a bulletin board, and other educational resources.

The Alabama Department of Education, http://www.alsde.edu, Office of Technology Initiatives (OTI) wanted an education web portal. They asked the Alabama Supercomputer Authority (ASA), http://www.asc.edu, to develop, host, and maintain it. ASA is a state agency that provides a supercomputer for the state. The supercomputer is used mostly by higher education for research. ASA also runs the Alabama Research and Education Network (AREN), which provides Internet access for Alabama public K-12 school systems, libraries, postsecondary colleges, four year colleges, and universities. OTI was familiar with ASA's work because of the technical support they provide to the Alabama Virtual Library (AVL), http://www.avl.lib.al.us, and its role as the Internet Service Provider for Alabama's educational institutions.

At the time, there was a significant need for a website that would provide teachers with a way to access teaching guidelines, search them, and find lesson plans that would assist them in the teaching of those guidelines. ALEX provides one central location for educators to find teaching resources and collaborate with statewide counterparts. Before the deployment of ALEX, most teachers shared one book of content standards for each course of study. Content standards are guidelines that teachers are required to use when teaching students. There are content standards for each course of study or subject. Because of this new education portal, accessing the content standards is more convenient for teachers.

ALEX System

From a development standpoint, ALEX is divided into seven sections as illustrated in Figure 3.1. They are teacher-created lesson plans, personal workspace, courses of study content standards, web resources, teacher-to-teacher, teacher zone, and MarcoPolo lesson plans.

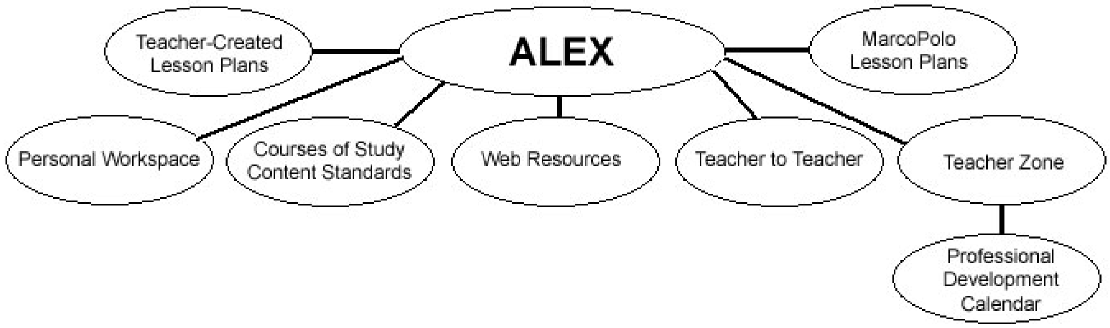

Figure 3.1 ALEX System Architecture

Additional sections have been added to make the site user friendly and easy to use. These sections include the search, help, suggestion box, and site map sections.

System Configuration

The system, as illustrated in Figure 3.3, consists of two Linux servers. One is the web server and the other is the database server. The web server has Red Hat Linux release 7.2 installed, and the kernel version is 2.4.7-10. It runs Apache software version 1.3.22. It has one 600 MHz processor with approximately 20GB of disk space and 256MB of RAM. The scripting languages used in the development were PHP and Programming Extracting Reporting Language (PERL) which both reside on the web server. The database server has Red Hat Linux release 7.3 installed with kernel version 2.4.18-19.7.xsmp. It has two 2.2GHz processors with approximately 758GB of disk space and 1GB of RAM. The database server runs MySQL version 3.23.56.

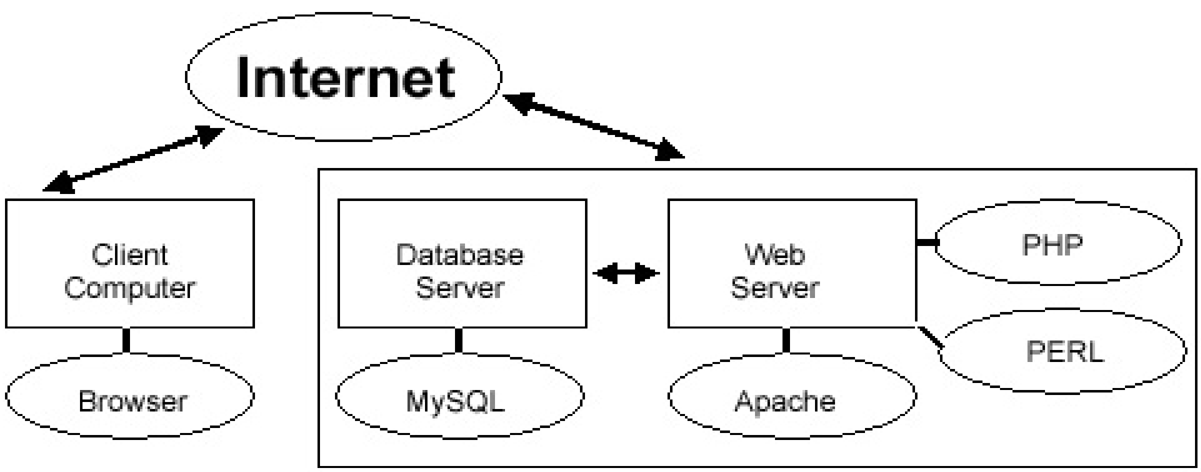

Figure 3.3 ALEX Servers

Courses of Study Content Standards

Alabama has content standards, guidelines, for each course of study or subject. The tblStandards database table was created to hold content standards for all subjects. The table was designed to make sure that data could be displayed very similarly to the way it was displayed in the course of study content standard books distributed by the Alabama Department of Education to K-12 teachers each year. These content standards can be browsed and searched by subject and grade. A keyword can also be specified in a search. Results are presented in two formats. One format is very similar to the way standards appear in the book. The other format is a printer friendly version. Both versions include the course (subject), year, grade(s), topic (within the subject area), and links to related web resources and lesson plans for each content standard.

Personal Workspace

ALEX grants a personal workspace to users that register to create an account. An online form is provided for registering, users are asked to enter their name, a user name, and an email address. When the user clicks submit, this information is stored in the user database table. To complete the registration process, users must respond to a system generated email message from the email account they specified when registering. Within this email message is a link that the user must visit. The link includes a hash and an email parameter. These 2 parameters are compared with corresponding values that were stored in the user database table when the online registration form was submitted. Once confirmed, the user is asked to enter their affiliation information before they are allowed to use their personal workspace. Most users are affiliated with schools or other educational organizations.

The information presented in the personal workspace is dependent on the type of user that is logged in. If the user is a general user with no administrative or approval privileges, then they can create, modify, submit, and delete lesson plans and web resources. Users can also add and delete bookmarks to approved teacher-created and MarcoPolo lesson plans of interest, view administrative messages, and participate in groups. If the user is an administrator they can view additional items such as lesson plans, web resources, and variations awaiting approval, as well as other administrative reports.

Teacher-Created Lesson Plans

Teachers who register can use their personal workspace to create lesson plans. The “Create Lesson Plan” link appears on the personal workspace for all user types. A lesson plan interface is composed of three forms. The first form is where the user fills in descriptive information about the lesson plan such as title, materials needed, and duration of the lesson. Most of this information is required and JavaScript is used to verify that the user populates the required fields. From this initial interface the user has two options. They can associate this lesson plan with content standards or create steps. The lesson plan cannot be submitted for approval until it has been associated with content standards. First, to associate or align the lesson plan with content standards, the user is presented with a search screen. The user must select the course of study and grade that correspond with the lesson plan at hand. The user is then presented with content standards matching their search criteria. After aligning the plan by clicking the “Save Associated Standards” button, the user is returned to the initial interface where the aligned content standards now appear. From here, the user can opt to create steps. These steps make up the procedure for the lesson plan. A plan can have as many steps as necessary. Each step includes information like URL and duration for that particular step. Users can also associate attachments to the plan by uploading them via this interface. Once created, users can return to their personal workspace to modify, delete, or submit their lesson plans for approval.

Approval Process

Once submitted by the user, the lesson plan must go through an approval process before it can be included in the database of teacher-created lesson plans searchable by the public. Users that have been designated as approvers can view a listing of submitted lesson plans on their personal workspace in the “Waiting Approval” section. Approvers select the lesson plan they wish to review. Then they are presented with an approver’s screen, where they can view the lesson plan or check it out for a grammatical evaluation and/or a content evaluation. Approver’s can choose to check out a lesson plan for grammatical evaluation or for content evaluation. They can also choose to check out a lesson plan for both grammar and content. This decision is based on their area(s) of expertise. Approver’s are asked to check out plans so that other approver’s know that the plan is already being evaluated. Once a plan has been checked out once, it has to be un-checked before another approver is allowed to check it out. Plans are unchecked on the same screen that they are checked out on. This eliminates multiple approvers evaluating the same plans for approval purposes. Only after an approver has checked out a lesson plan can they reject or approve it based on grammar and/or content. Both grammar and content must be approved before the lesson plan is considered approved. If the approver chooses to reject the plan for either grammar or content they can provide comments to the submitter in the form of a message, which will appear on the user’s personal workspace. This helps the submitter determine why the plan was rejected and make suggested changes before submitting the lesson plan again. The approver can also edit the plan themselves as needed. If the plan is approved, the plan submitter is sent a message informing them that their plan has been approved. That plan is now included in the publicly searchable database of teacher-created lesson plans.

Group Functionality

If users have been designated as group leaders they have additional group options to choose from. They can create and rename groups that they are administering; they can add, view, and delete group members. They can also approve or reject lesson plans submitted to them by group members. Group members can submit their lesson plans to the group leader, rather than directly to the approval process. If the group leader chooses to reject the plan he/she can provide comments to the plan's creator, which will appear in the message section of the creator's personal workspace. If the group leader chooses to approve the lesson, it is submitted to the approval process. As described earlier it must be approved before it can be included in the publicly searchable database of teacher-created lesson plans. Group members may choose to leave the group at anytime.

Ranking

Portal users can anonymously rank approved teacher-created lesson plans. They are asked to rate the usefulness, content, and creativity of the lesson plan based on a scale from 1 to 5. Users may also provide comments along with these ratings. The results are accessible on the personal workspace of administrative users under "Ranking Results". The average ratings for usefulness, content, and creativity are shown along with any comments that may have been submitted along with the ratings. The date the ratings were submitted and the IP address of the submitter are also included. This precautionary information was added, so administrators would know if a user was trying to skew the results by ranking a lesson plan several times.

Variations

Users can suggest modifications to approved teacher-created lesson plans. An interface is provided where they can suggest that certain areas of a lesson plan be modified to expand its usability and/or to improve its effectiveness. Attachments may also be uploaded to support the suggested modifications. These changes must then be approved. If the lesson plan is rejected the approver can supply comments to the submitter explaining why. If the modifications are accepted they are appended to the existing lesson plan. From that point on, the variation will always appear with that lesson plan.

MarcoPolo Lesson Plans

The MarcoPolo Education Foundation, http://www.marcopolo-education.org, has seven partners that provide MarcoPolo lesson plans. The John F. Kennedy Center for the Performing Arts, http://artsedge.kennedy-center.org, provides lesson plans dealing with the arts; the National Council on Economic Education, http://www.econedlink.org, provides economics related lesson plans; the National Endowment for the Humanities, http://edsitement.neh.gov, provides humanities types of lesson plans; the National Council of Teachers of Mathematics, http://illuminations.nctm.org, contributes mathematical lesson plans; the International Reading Association and The National Council of Teachers of English, http://www.readwritethink.org, contribute reading and language arts lesson plans; the American Association for the Advancement of Science, http://www.sciencenetlinks.com, provides science lesson plans, and the National Geographic Society, http://www.nationalgeographic.com/xpeditions, provides geography lesson plans. These MarcoPolo lesson plans have been incorporated into the ALEX network based education system. Website visitors can search for lesson plans by specifying subject(s), grade(s), and specific topic(s) within the chosen subject area(s).

Alignment

MarcoPolo lesson plans are aligned to the Alabama courses of study content standards. Users who have been designated MarcoPolo aligners can search for MarcoPolo lessons to review. To review lessons, aligners are presented with the MarcoPolo lesson plan search interface. Aligners can choose the subject, grade, and topic to search for relevant MarcoPolo lesson plans to align. A list of MarcoPolo lesson plans is retrieved. This listing includes links to MarcoPolo lesson plan(s) that match the search criteria and a list of content standards that the plans are already aligned to. Once a lesson plan has been reviewed aligners can align it to corresponding content standards. To do this aligners are presented with another very similar search interface. In fact, it is the same interface that is used to search for course of study content standards described earlier. Aligners select course of study, grade, and topic; they also have the option of entering a keyword. The resulting list of MarcoPolo lesson plans is then aligned to content standard(s).

Web Resources

Users can search for web resources that have been correlated to Alabama content standards and view pre-selected web resources that have been categorized by audience and type. Registered users can submit web resources to be included in this list of categorized resources. Furthermore, submitted resources are correlated to content standards. To submit a web resource users must provide the URL, a title, the targeted audience, and a brief description of the website. Users must also align the web resource by selecting content standards that it addresses. This is done the same way that teacher-created and MarcoPolo lesson plans are aligned to content standards.

Professional Development Calendar

The Teacher Zone is designed to provide announcements, grant opportunities, and other information that teachers can use to increase their knowledge and improve classroom instruction. The professional development calendar is included in this section and allows users to create and view professional development opportunities across the state of Alabama. To submit an event for inclusion on this calendar the user must include information such as the following: the title of the event, a description of the event, the sponsoring organization, the location, the date, the cost to attend (if any), and seating availability. JavaScript is used to verify that all required information is included before the information is submitted. Once submitted, users are allowed to re-use this information to submit events for additional dates; they can modify any of the original information. The user is sent an email message asking them to confirm that they submitted an event for inclusion on the calendar. They must click on a link in the message to confirm that they submitted the request. To approve events, approvers' use a similar interface to the one the public uses. They have administrative permission, so they can see the status of all submitted events. An event can be assigned three different types of statuses: submitted, confirmed, or approved. Once an approver approves an event, the event becomes viewable to the public. This is implemented by updating the approved field in the calendar table. Designated approvers can edit any event's information at any time. If the approver decides to reject the event, it is deleted from the calendar database table. This section also has a search feature. Users can search by category, date, grade, and seating availability.

Other Features

The last section, teacher-to-teacher, makes use of freeware. This section offers listservs and forums. Mailman, http://www.gnu.org/software/mailman/, is the listserv software that is used. Thirty-one listservs have been created for each type of teacher and administrator. For instance, there is a listserv for elementary physical education teachers, foreign language teachers, elementary school principals, elementary school counselors, middle school math teachers, high school music teachers, etc. The mailman software provides several user interfaces for subscribing, viewing and editing subscription information. Users can change passwords, digest messages, and unsubscribe, etc. An administrative interface is also available for modifying list configuration information. Forums are available for discussion among ALEX users. Ten forums are currently available for discussion. Polls have also been setup for users to vote on. These polls serve as a way to get feedback from users on a variety of issues.

Reports

Users that have been assigned a user type of administrator have access to reporting tools. In some cases additional users are granted access to these reports. There are four types of reporting tools: website usage, registered user information, teacher-created lesson plan statistics, and MarcoPolo lesson plan information. Website usage tools are available courtesy of Webalizer, http://www.mrunix.net/webalizer/, free software that generates charts and graphs from web server log files. Webalizer provides tables and charts, which include statistics on the number of hits, files, pages, visits, and Kbytes processed per hour and per day.

Information on registered users is available for administrators. This tool incorporates a search feature so administrators can search for users by names or usernames. Administrators can select a user from the list of search results and edit user information. Additionally, administrators can assign administrative privileges. Finally, administrators have the option of deleting users from this interface.

Teacher-created lesson plan information is provided for administrators and designated school system contacts. The first interface allows administrators to search for approved lesson plans. A user interface allows administrators to search by title, the lesson plan's author, or the author's school or school system. A second interface is designed for school system contacts. In addition to approved lesson plans, submitted lesson plans are included in this report.

MarcoPolo reports are available to users with administrative privileges. From this screen administrators can view alignment information. They can search by username or enter a date range. Search results include lesson plans that were aligned by the given user or during the given date range. Accompanying information includes the content standard(s) each lesson plan is aligned to along with the date and time of alignment.

Database Structure

The database consists of 22 tables. Included here is a brief description of each table and its function. The reference table contains definitions for course and subject codes used in the tblStandards table. The tblStandards table holds the content standards for every course of study. The bookmarks table stores links to ALEX and MarcoPolo lesson plans; this allows users to maintain bookmarks to these resources on their personal workspace. The calendar table is where events for professional development sessions are stored. The group_members table keeps track of the users that are group members. The lessonplan table stores the teacher-created lesson plans. It includes descriptive information about the lesson plan such as the duration of the plan and the materials needed to complete the activity. The steps table contains the procedures associated with a lesson plan. It lists the steps that must be taken to complete the activity. The marcopolo table stores information about MarcoPolo lesson plans. The messages table stores messages that appear in the personal workspace area. The ranking table allows lesson plans to be ranked by users based on usefulness, content, and creativity. It also includes comments. The schools table lists all the public schools in the state, so educators can select their school system and school when registering. User information is stored in the user table. The variations table holds suggestions for varying or enhancing lesson plans. The weblinks table stores URLs that are aligned to content standards.

Conclusion

The process used in the creation and maintenance of ALEX has been outlined in this paper. The ALEX system is an effort to encourage the K-12 education community in Alabama to improve education by pooling resources. The ALEX system continues to grow. Expansion has been built into the ALEX system. Therefore, as long as teachers continue to find the education system helpful, they will continue to contribute teacher-created lesson plans, variations to teacher-created lesson plans, and web resources. The more resources available on the system, the more valuable the system will become to the Alabama K-12 education community.

Future work entails adding other types of valuable lesson plans and resources that are similar to MarcoPolo lesson plans. An ongoing duty of maintaining the ALEX education system is implementing suggested improvements from users to make the education system easier to use.

Ensuring Program Success through Learning Communities

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Abstract

Scholarship has focused upon the transformational learning fostered by effective online learning communities, but has not addressed how faculty of a distance program can use community to sustain persistence to degree completion. This includes a variety of learning communities: (1) initial cohorts created during an introductory course; (2) communication throughout the program through threaded discussions, synchronous office hours, and instant messaging; and (3) course-related communities developed by the online instructors for each course.

Persistence in Distance Education

The advent of the Internet has seen a plethora of online courses, degree programs, and even distance institutions emerge. The Web is available to a majority of households in developed countries and becomes a convenient instructional delivery vehicle that meets the lifestyle demands of working adult students. Kember (1995) conducted a seminal study of student progress in open and distance universities in four countries that explains persistence based on social and academic integration. His model, a significant extension and reframing of earlier scholarship, is limited to pre-internet distance delivery modes, examining only course-level attrition. Currently completion rates for online courses are usually much better (roughly 80%) than that of independent study (often less than 50%) because the student has a greater sense of strong peer and instructor support, structure, pacing, and accountability. Even so, the excitement of this technology to access information and provide substantive discussions often gives way to the day-to-day grind of near-daily communications, frequent assignments, and the isolation, fatigue, and complacency. Scholarship about learning communities has focused primarily on the intellectual discourse faculty members promote in these environments – discussion that allows students to formulate and articulate their positions, validate or recast those perspectives in light of peer and faculty input, as well as mature in their appreciation for the diversity of academic thought. There has been little attention to the impact this learning environment has upon persistence – particularly beyond the individual course to the program completion facilitated by this technology.

Learning Communities to Enable Persistence

This paper explains how a distance degree program or online institution can engender learning communities throughout the students experience with the institution in three crucial ways. First, they can create the social and academic bonding of students who begin the program together, encouraging the cohort to support each other as they move through their studies. Second, the advisor/mentor who guides the student throughout their degree program can foster continual peer support as she or he engages students in important discussion not bounded by courses. Finally, in each online course faculty members should purposefully create an environment of intellectual discourse – engaging the student group in deep processing of course content and knowledge-making. Each of these is further elaborated upon below.

Initial Cohort Seminars

Creating initial learning community with a cohort group of students entering a degree program is common in face-to-face programs. Many distance programs may inaugurate their ostensibly online program with in-person meetings, simply to get students comfortable with each other and the faculty members. Several distance institutions have created an initial course that fosters the initial formation of a program online learning community. Often lasting three to four weeks this introductory course promotes the development of social relationships among peers as they explore with the online instructor the challenges of being a distance student, address academic skill development, formulate a degree program plan, gain skills in using the library at a distance, and learn how to use the

Web platform (learning management system) through which they will be taking their instruction. They are encouraged to continue this relationship thereafter.

Continuous Mentor Involvement

Most online programs feature a faculty advisor or mentor who works closely with the student throughout their program of study, beginning with the introductory course. Successful programs have mentors who regularly communicate with students from one semester to another, fostering peer interaction that extends beyond the course interaction. They can facilitate these kinds of learning communities by threaded discussions among their cohort of advisees, through group online office hours to handle questions and issues that come up outside of regular online classes, and through instant messaging where they demonstrate their availability and on-going interest in individual student progress. Ludwig-Hardman and Dunlap (2003) give details about how mentors at Western Governors University (WGU) play a pivotal role in scaffolding learners' cognitive and social development through learning communities, thereby improving student persistence.

Content-based Learning Communities and Student Success

The impact of learning community formation on distance course completion is tremendous. Eastmond (1995) proposed the Adult Distance Study through Computer Conferencing model to predict success with online study at the course level based on qualitative research of several distance courses. It includes such factors as (1) readiness – the personal and environmental elements that prepare the learner for online study; (2) online characteristics – factors of the internet environment itself that are similar or dissimilar to conventional education; and (3) learning approaches – those strategies that students borrow or invent to successfully negotiate computer-mediated instruction. Gunawardena and Duphonrne (2000) found these factors to be valid through a separate quantitative research study. The importance of the online learning community to bring about transformational learning, is the prominent feature of an online course. Palloff & Pratt (1999) tell that instructors and students need to be able to volunteer their opinions, understanding that they will be challenged, but believing in the greater good that will result. Through this interplay, all participants will expand their critical thinking, come to appreciate diverse perspectives, and construct for themselves a fuller understanding of the topic the group is investigating. Mutual trust for social inquiry must be nurtured in all group members by instructor and students alike.

The Instructor Role in Learning Communities

The instructor's plays an essential role in creating the online course learning community. The e-moderator's role needs to shift from presenter of content to "guide on the side" – moving away from initial tasks of addressing technical and social concerns to facilitating learning: information exchange, issue and practice processing, and knowledge construction (Salmon, 2000). The e-moderator's role best fosters this learning when the e-moderator's control, authority, and domination of the conference gradually shifts to learners who exert growing autonomy over their own learning process. The moderator's role is to clarify communications, encourage disparate opinions, summarize what has been said, keep the group focused on its objective, and weave messages that "find the important points, common threads and disagreements to clarify a discussion that has gone off-direction" (Winograd, 2002, p. 56).

Beyond Course Learning Communities

Not only are online learning communities important for the intellectual inquiry found in course dialog, but that they are also essential for the social and academic integration necessary for distance degree program completion. In developing resources for student success in online programs, Duin, Baer, and Starke-Meyerring (2001) note that tools for relationship building are the most critical but overlooked part of e-learning. This includes such tools as interactive e-portfolios, e-mentoring, and intentional e-learning communities. This latter item, e-learning communities, are intentionally set up for learners to interact between themselves throughout their program and with instructors – since all of these adult participants have expertise to share. At WGU we have developed areas on an electronic bulletin board area for each degree program where students can access key resources and interact amongst themselves and the instructor about the competencies being developed and assessed for each domain of our competency-based degree program. These learning communities become "a place where learners can test assumptions, try out new ideas, and ask difficult questions by way of the company and support of other learners" (Bauman, 1997, p.88). By so doing, the institution enables the creation of educationally-rich virtual learning communities, similar to the out-of-classroom environment that traditional higher education institutions try to engender for enhanced learning, socialization, and affiliation – important means for enabling student progress.

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A Miracle or a Menace:
Teaching and Learning with Laptop Computers in the Classroom

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Abstract

All freshmen at West Point now have laptop computers to facilitate their learning experience. In this presentation we share teaching techniques, lessons learned, and student performance while using laptops in the classroom. Presenters will demonstrate techniques to effectively leverage the laptop technology in a way that enhances the delivery and efficiency of instruction as well as enhances student learning and interest. Additionally, we will present both quantitative and qualitative data comparing laptop classrooms with traditional classrooms for the same course.

Introduction

Increasingly, college students are showing up to the classroom, not with paper and pencil in hand but with laptop computers. Is this new educational tool a miracle or a menace? Is it advantageous or disastrous? How can you, the educator, get maximum value out of students using laptops in the classroom and will this technology increase student performance? All freshmen at West Point now have personal laptop computers to use in class. Several instructors for the General Psychology course for all freshmen are currently incorporating classroom learning activities and strategies to leverage the technology tools available with the laptop computers. The purpose of this study was to examine teaching techniques, lessons learned and student performance during the integration of laptop computers to teach and learn psychology in the traditional face-to-face classroom to enhance teaching practices and efficiency and positively influence student learning and attitudes toward psychology.

As we present our findings, we will try to highlight the influence of laptop technology on student performance (learning) and attitudes (motivation/interest) as well as the impact on teaching efficiency. Even miraculous results could be easily discounted if using such technology is a menace for teachers to integrate into their daily practices. We developed a short acronym to categorize the impact that laptop technology had on student motivation/interest (M), teacher efficiency (E) and student learning (L). Our intent, then, was to integrate laptop technology (T) in such a way to prevent the teacher from literally having a technology 'MELT-down' from another menacing 'great idea' about integrating technology.

We initially attempted to integrate the laptop technology into the classroom during our summer teacher training sessions. We soon discovered that the returning faculty members participating in these training workshops were not very motivated to integrate the technology. Many instructors felt uncomfortable with teaching while students were actively pounding the keyboards to take notes. Additionally, many faculty members believed that many students would quickly engage in activities not related to the class. Giving up this 'control' in the classroom was not acceptable to selected faculty. One faculty outwardly stated "My students won't be using those laptops in my classroom." Faculty's initial attitudes had an adverse impact on our attempts to get students using laptops in the classroom.

Another critical limitation influencing faculty utilization of laptops was whether faculty members actually owned a laptop. During our faculty training, we used 'loaner laptops' and then turned them in before classes started. We soon discovered that faculty members were much more likely to attempt utilizing laptops in the classroom if they actually had their own office laptop. Fortunately, we were able to acquire 4 laptops for the 4 instructors who participated in this study. Consequently, when we issued laptops to the six new instructors on our faculty this year, which is the semester after this study was conducted, all 6 instructors aggressively worked to integrate laptop technology into their classroom strategies.

Another hurdle to laptop integration involved our learners. Because this was the first year that students at the Academy had laptops in the classroom, the students were also quite speculative about the utility of this newfound technology in the classroom. They definitely saw advantages to doing email and Instant Messaging in class, but using it as a tool for learning was not evident at first. Several students simply resorted to paper-pencil note-taking with a closed laptop beside them.

Method

Participants.

The study involved 10 General Psychology instructors who taught 527 college freshman students in 30 classroom sections (average of 17 students per section) at West Point. Students were randomly assigned to their classroom sections. The instructors and students used the same textbook, curriculum, learning objectives and exams.

Design.

A quasi-experimental design examined the effects of utilizing the laptop technology on classroom practices, student learning and attitudes. Instructors (six) in the control group did not incorporate laptops into their teaching strategies for 22 student sections, while four instructors in the experimental group used the laptops to facilitate their learning activities in class for their 8 student sections. The four instructors volunteered to participate in the study. These instructors varied in experience. One of the instructors has a PhD in education and 5 years of teaching experience. Two of the other three remaining instructors were first-year teachers while the final instructor had three years of teaching experience. All three of the teachers had masters degrees in psychology.

Measures.

Six exams (combination of multiple-choice and short answer) and a final exam (100 multiple-choice with reliability of r = .81) assessed student learning of course material. All exams were the same for all students (taken at the same time) and instructors held calibration sessions before the exams to maintain consistency in grading criteria. A typical end-of-course survey assessed student attitudes toward the course and the integration of technology.

Because the Academy was in the process of configuring classrooms for wireless technology, we used three different types of technology classrooms to best simulate a wireless technology environment. One instructor had access to a wireless ready classroom, one instructor used a standard desktop lab that simulated wireless capability with a server, and two instructors used the laptops in the traditional classroom with limited wireless capability. Interestingly, even in the most wired 'hi-tech' classroom, several students refused to use their laptops and chose to stay with the traditional paper-pencil note-taking.

'Bringing learning to life' classroom techniques

What follows are various techniques and strategies that were used in the laptop sections to 'bring learning to life' to enhance student interest and motivation and various techniques to facilitate practice and feedback. By having students use the laptops in the classroom, the teacher has a much wider range of instructional and classroom tools available. The advent of wireless networks across campuses fits hand-in-hand with laptop use. A wireless network is not just for the students to use in the library or their dormitories, but it should also be used by the students and the instructors in the classroom. The instructor now has the flexibility of simultaneously having all their students go to the World Wide Web during class and going to specific web sites that are related to class. The web is full of interactive and interesting sites that quickly and efficiently (E) demonstrate key classroom concepts. The web sites can be used as a topic introducer, a discussion generator and point solidifier. For example, the instructor can have the students go to a particular web-site that will illustrate or introduce concepts and phenomenon that are related to concepts to be covered later on in class. These same web sites often spark interesting discussion and debate which really engages the students' interest (M). Similarly, after just covering an abstract psychological concept, the class can go to a web-based exercise that illustrates the concept in action. Finally, often topics come up for which the instructor did not prepare or are outside the scope of class but that can quickly be looked up on the web. Quick, in-class research is a great tool. For example, suppose the days' class is on sleep deprivation. The instructor could quickly say, "Okay, student X, I want you to find who holds the record for the most consecutive hours without sleep and student Y find me five symptoms of sleep deprivation." Within five minutes, the instructor and the class would have the answers. This easy, quick activity (E) increases the students' motivation (M), keeps their interest by giving them in-class activities, and ultimately contributes to learning (L).

If there is one activity in which today's generation enjoys engaging, it is computer games. Since this motivation (M) already exists, the key is to harness this interest and bring it into the classroom. For example, when teaching the experimental method, one could use any number of computer games to "test" hand-eye coordination of your students. Of course, it would probably be necessary for you to bring in the "pill" (perhaps a green M&M®) that you have "developed" to improve hand-eye coordination. The instructor could have the students design the study, develop the hypothesis, figure out how to choose participants, divide the participant into the control group and experimental group, etc. Then have the students do the experiment, have them take the pill and play the game on their computer. Within an hour-long class, the students can go through and execute the entire experimental method to include, perform the experiment (on the laptop), gather the data, analyze the results using programs on the laptop computer such as Microsoft® Excel and even talk about methodological problems associated with the classroom "experiment."

Another great use for the computer is digital media. Nothing captures the students' attention like a clip from a popular movie, television show or funny commercial. One may ask, "Well, why is there advantage with laptops and digital media? I use digital media from my room computer already." The big advantage of digital media is in the area of motivation (M) and learning (L). With digital media, the instructor can share with the students via email or other sharing techniques, the digital clip that was used in class. We have found that these students then go back to their rooms with their laptops, or take their laptops home, or to the coffee shops with their friends to study and they share the video clip with others. We have found that they are not only sharing the clips but they are then explaining to their friends, parents, boy/girlfriends, etc. the principle or concept tied to that video clip. The digital media brings the learning (L) and motivation (M) outside the classroom, and any time that we can get our students excited and talking about our discipline outside the classroom, it is "a good thing."

Lastly, nearly all introductory psychology textbooks now come with a CD-Rom enclosed. Most instructors and students seemingly ignore this valuable learning (L) tool. Perhaps the most valuable tools available for the classroom on these CDs are the simulations, demonstrations, and exercises which can often be used in the same manner as the web-based exercises discussed previously. These exercises are usually fun and interesting and comments from the students show that they motivate (M) their learning (L). Before laptops in the classroom, instructors could perhaps assign these exercises as homework, suggest that the students look at a particular demonstration, or best case, demonstrate it themselves on the classroom computer for all to watch. The instructor no longer has to wonder whether the student did the assigned simulation nor does the student simply have to watch as the instructor performs the exercise in front of the class. Now each student can put their own CD into their own laptop and do the class exercise while the teacher circulates the room and monitors everyone's progress. These exercises, demonstrations and simulations typically only take up 5-15 minutes of class time and at the completion each student has had a common experience which can lead to rich classroom discussion. Additionally, by putting into practice concepts just studied, the CDs tend to cement the concepts into the students' mind. They now have a visual, auditory and tactile tie to what they have read for homework the previous night and that is going to be covered in class that day.

Practice and feedback classroom techniques

In this section we include various techniques for effectively utilizing laptops in the classroom. These techniques really affect the efficiency (E) of classroom procedures while promoting learning through responsive feedback enabled by technology.

Digital Syllabus

Provide an editable, digital syllabus. Provide a detailed syllabus (skeleton outline of your lesson plan) which lays out the "big-picture" lesson objectives as well as the lower-level performance objectives which spell out the concepts with which the student must be familiar before attending class. By providing the digital syllabus, students can do their lesson preparation on their laptop computers by adding their notes in a different color right into the course guide that we provide. Taking notes in a different color makes it easy for the student to follow-along in class, and also makes it easy for the instructor to walk around and see which students have prepared for class. While in class, students can use a third color to update or correct their notes as required and to highlight those concepts upon which the instructor focuses. By the time class is complete, the student has produced a legible resource for future use and study.

"Beam Solutions"

Use wireless capability to "beam" student homework solutions on the board for review. The wireless network allows for quick transfer of homework or in-class assignments to a digital drop box which can be accessed by the computer to which the overhead projector is attached. Most classrooms have either a chalkboard or dry-erase board behind the screen. Once in the digital drop box, the instructor can "beam" any student's solution onto the board where it can be annotated to illustrate either common pitfalls or exemplary work. Since the source file was created on the laptop, then the owner of the on-screen assignment can correct his work as the teacher does. At the end of the exercise each student has a correct example of a given type of problem. We have found that for classrooms that are not wireless, the student can save her work on a disk or CD and then the teacher can simply load it up on the classroom computer. Compare this technique to doing in-class work on chalkboards. Not only can the student and instructor cover multiple examples (E), when simply solving problems or doing homework on the chalkboard, any feedback or corrections end up as a pile of dust in the chalk tray when erased at the end of class. Finally, using actual student responses seems to be more meaningful (M) to our students then "canned" examples that may or may not cover specific difficulties that our students may be having.

Software interaction

Incorporate use of discipline-specific software in classroom exercises. Our instruction on correlational research incorporates an in-class exercise in which we try to correlate video game exposure with academic performance. Rather than cite some study which the average student cannot relate, we used a spreadsheet program to calculate the correlation coefficient and its associated p value for the students in our class. Using personalized data really brings what can be "dry" material to life for students (M) because it is their data. At the same time it allows instructors to cover higher-level concepts. Finally, the student gets practice using a tool to calculate an important statistic which she will then interpret. At the end of class, the student can "take away" the data set and have something for further study or reference as desired.

In-class group projects:

Use laptops to create in-class group projects or presentations. Many phenomena are explained by different, competing theories. Since each student has laptop, instructors can assign each group to prepare a five-minute presentation covering a theoretical perspective. Students can use the presentation software on their laptop to create their brief that will be given to the rest of the class. After sufficient preparation time, each group can "deposit" their presentation in the digital drop box (or save it to a disk) so that it can be displayed on screen as they give their presentation. This technique allows students to practice speaking skills, get detailed study of the theoretical perspective they were assigned, get a presentation on the other theoretical approaches presented by the other groups, and take away electronic copies of all the presentations created by their classmates.

Results

We assessed students' performance using in-class exams. Students of instructors who integrated laptop computers into their classroom strategies (experimental group) scored significantly higher ($p < .05$) on all 6 exams and the final exam than students of instructors who used traditional instructional and note-taking methods (control group).

We assessed students' attitudes through End-of-course surveys. We categorized the 42 questions into one of the three dimensions examined in this study, which included student motivation/interest (M), instructor efficiency (E) and student learning (L). Nine of the 15 questions (60%) related to student motivation and interest were rated significantly more favorable ($p < .05$) in the technology sections. For example, on a Likert scale of 1 (strongly disagree) to 5 (strongly agree), students in the technology sections rated instructors significantly higher on the following question categorized for student motivation (M): "My instructor was enthusiastic and energetic when presenting course material." A similar trend in favor of the technology sections was also evident in 3 of the 5 questions related to teaching efficiency (E) and 9 of the 22 questions (39%) related to student learning. Overall, students in the technology sections (experimental group) rated questions on this survey more favorably than the traditional sections (control group) and 21 of the 42 questions (50%) were statistically significant ($p < .05$).

We also included two open-ended questions on our end of the course survey. The two questions were: "What did you like about using your laptop in class?" and "What did you dislike about using your laptop in class?" We took all responses to these questions and categorized the common responses.

For "What did you like about using your laptop in class?" the comments fell into two main categories. Of the students that used the laptops in class, 73% made comments that fell into the category of ease in note-taking or ease of organizing/reading their notes. These comments highlight the efficiency aspect of taking notes in class. Some sample comment include:

- "Typing is a faster more efficient way of note taking."
- "I could take notes faster & keep my stuff organized."
- "I had all my notes (on laptop) & could add to them when I felt appropriate, & they were kept very neat, organized & readable on the computer. In a notebook, they possibly would have been lost or neglected, or less legible & organized."
- "I did not have to shuffle through papers. All I had to do was hit page up or page down and I had the information I needed. It was also neater than my handwriting so i could read it easier and faster."

- “It is faster, neater, and more efficient in taking notes.”

24% mentioned other uses of the laptop such as computer and internet exercises to include web sites, CD ROM exercises, games. These comments highlight the motivation aspect of using laptop for classroom activities in the classroom. Some sample comments include:

- “I like some of the experiments that we did on the CD in class.”
- “We were able to access various websites & tests that related to the material.”
- “I liked the group time when we used the computer to type things down & then present them in class…it was a VERY effective learning tool.”
- “It allowed us to use simulations to do different experiments during class.”
- “I liked using my laptop because we could use the internet to look at stimulations relating to the course material.”

For “What did you dislike about using your laptop in class?” the comments also fell into two main categories. 50% of those students who did use the laptop did not like carrying it back and forth to class—mainly because they felt that it was heavy and cumbersome to bring to class. Sample comments include:

- “Pain to carry to class.”
- “Bulky to carry around.”
- “Lugging it around from class to class.”
- “Carrying the laptop is always a chore.”
- “I dislike the fact that we had to haul the laptops to class. I hate carrying my laptop around.”

32% of those used the laptop made comments that fell into the category of learning style and typing skills. These students still preferred to take notes with pen and paper because they a) did not know how to type, b) did not like the fact that they could star, draw arrows to, or make notes in the margins, or c) they felt the learned better by writing notes by hand. Sample comments include:

- “I feel as if I learn better by writing things down as opposed to typing them.”It is hard to enter charts and graphs into the laptop with efficiency.”
- “I found it much easier to add notes to the margins and maneuver through the course guide in paper format.”
- “Sometimes I could not type fast enough to take notes in class.”
- “It takes me longer to type than write and sometimes its easier to draw diagrams than write something out in words.”

Lesson learned

This section will cover some of the practical aspects of using laptops in class. Specifically it covers classroom management techniques, some dangers and pitfalls, and finally some of the benefits of using laptops in class.

Classroom Management Techniques: (E)

Batteries only – no cords. With a classroom full of computers, battery power is a must. If each student had to plug in their laptop, some form of accident would be inevitable. The instructor will eventually trip over a cord and hurt himself or the students $1500+ investment.

Provide an editable, electronic syllabus. This will allow students to do their before-class preparation and in-class note-taking as described above.

Screens down during movies. Require students to put their screens down during movies so that they don’t interfere with another student’s ability to focus on the screen, and so they “get” what you intended during the film.

Employ a “No Outside Work” Policy in class. Our students cannot skip class without punishment, so there has always been an occasional tendency to try to complete requirements for another course during class time. Enabled by wireless access to the internet and network folders, the laptop merely provides a new means to try to do this. Don’t be afraid to tactfully address violators. A direct but tactful request is generally all it takes to get students back on track.

Publish a set of “Classroom Rules.” We find that most students want to do the right thing most of the time. Providing a list of norms will ensure that your students know what is and what is not allowed in class.

Dangers and Pitfalls

Surfing the Web. Initially, this is the biggest challenge to using laptops in class. Fortunately, it is easy to spot because students are decisively engaged with the computer, but there is not much keyboard activity involved. As mentioned above, a direct but tactful request is generally all it takes to get students back on track.

Instant Messaging. This is also a big challenge during the first couple of classes. Unfortunately, it is more difficult to detect this activity because it does resemble taking notes. By moving around the class and behind the students, you will keep most folks on track. Another technique is to look at which programs or applications are active and which ones have been minimized. Again, a direct but tactful request is generally all it takes to get students back on track.

Legitimacy of websites. Using the internet is one way to spark interest in your topic, but students must not leave class thinking that every site visited in class is "scholarly." For example, a web-site offers little applets to help students determine the "sex" of their brain. While useful for generating classroom discussion, that web applet should not be confused for a scholarly resource. Other sites have similar issues.

Trying to have a computer exercise for everything. The laptop is a tool that can be used by the instructor to facilitate learning, but it should never be the focus of the class. Some topics are better covered in small-group discussions, some concepts are better brought to life with other teaching techniques such as skits. Sometimes the laptop is not the best teaching and learning tool. The key is to use the most appropriate medium for the material to be covered (E).

Benefits of Laptops in the classroom:

Using computers in the class promotes computer literacy for life-long learning (L). The common assumption is that today's college freshmen are computer literate, but we have found that they are very good at using the internet, instant messaging, and playing games. Many of them are not very good at using the software applications most useful for schoolwork. Using computers in class "encourages" them to learn how to effectively use the tools that they will be using the rest of their college "careers" and beyond.

Using laptops in the classroom also increases efficiency in practice and feedback in the classroom (E). Since students can easily submit their assignments and have them shown on screen, instructors can cover more assignments in class than would be feasible with transparencies or on the chalk board.

Finally, using the laptops so each student can play a game, or go to a website, or do an on-line experiment does really seem to spark student interest (M) in psychology than demonstrating those same items on the big screen or other traditional techniques. In the end, getting students excited about learning is what we are all trying to accomplish.

Discussion

Laptop computers are coming to the classroom whether you are ready or not. Will you be ready to turn this new yet prevalent technology into a benefit for you and the learner or will it simply be a distraction? In this paper we have shared with you several useful techniques for both bringing learning to life and for feedback in the classroom that we have discovered after one semester of teaching introductory psychology to a classroom full of students with laptop computers. We have found that these techniques 1) increase the students' motivation (M) about the topics covered, 2) add efficiency (E) to the classroom in both note-taking and amount of material covered and 3) seem to actually increase the students learning (L) (as was supported by the increased tests scores of those students in the laptop vs. no laptop classrooms).

Employing the laptop computer in the classroom is not all easy. It is work. Often this means revising nearly all your lesson plans and thinking about your topic in fresh, innovative ways. As discussed in the paper, there are many dangers and pitfalls that can only be avoided by utilizing different classroom management techniques. However it has been our experience that in the long run the benefits outweigh the costs and we wish you luck in your endeavor to effectively utilize laptops in the classroom.

A Case of Supporting Distributed Knowledge and Work in the U.S. Navy: The Challenges of Knowledge Management to HPT

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Abstract

Knowledge to maintain and troubleshoot complex systems is a vital asset to organizations. Consequently, the Navy has chosen to adopt precepts and practices from knowledge management (KM). From a human performance technologist's perspective, this raises two questions: 1) How to think about knowledge, particularly within a distributed setting? 2) How to develop solutions that allow for distribution across organizational boundaries? Drawing from compatible perspectives—communities of practice, activity theory, and institutional theory—I recommend thinking of knowledge as a process of participation in practice. Consequently, interventions need more creatively account for social and cultural features of performance. To illustrate, I present a case of distributed knowledge and work between virtual teams in the U.S. Navy. Specific knowledge management strategies and solutions are offered in conclusion.

Introduction

Over the past year I have been conducting user, task, and context analyses as part of a larger project to develop a knowledge management system for the U.S. Navy. In this piece I share this experience as well as point out a few of the challenges encountered. Ideally, this account will provide the opportunity for others to compare their work, contributing to the discussion of how best to incorporate knowledge management tools and tactics into the practice.

A Knowledge-Centric Approach to Performance Improvement

The U.S. Department of Navy (DON) is in a technologically-intensive transition period. In essence, to counter a continued downsizing of on-board personnel the agency intends to leverage what is perceived as the added value of tacit, expert knowledge. Taking a knowledge management position, the goal is basically to improve efficiency and effectiveness. An explicit indication of this desire for change in knowledge, work, and technology is captured in Goal 4 of the recently released *Information Management & Information Technology Strategic Plan FY2002-2003* (Department of the Navy Chief Information Officer, 2003). The intent is to

> *[i]mplement knowledge management…strategies to facilitate collaboration and information sharing that optimize strategic and tactical decisions, resulting in more effective and efficient mission performance. Knowledge management… offer[s] the potential to significantly leverage the value of IT investments and the intellectual capital of our people. Information technology and information management are essential, but alone are insufficient to achieve information superiority. (p.20)*

Consequently, one approach to realize this strategy is to develop a performance support and knowledge management system. The system would aid at a distance the collaborative troubleshooting actions of military and civilian technicians and engineers maintaining a complex system aboard U.S. Navy warships. To undertake this task, designers and researchers from the Knowledge Acquisition and Projection Lab at Indiana University are participating in the Knowledge Projection Project – a joint undertaking with Naval Sea Systems Command (NAVSEA), Naval Surface Weapons Center (NSWC) Crane Division, EG&G Technical Services (a government contractor) and Purdue University. The anticipated system is intended to leverage both tacit knowledge and advanced information technologies. Accordingly, the design team at IU expects to exploit KM precepts and practices to positively impact key organizational variables, viz., total cost of ownership, maintenance and troubleshooting efficiency and effectiveness, and fleet readiness.

The system being proposed is meant to support knowledge and work distributed across individuals and organizational boundaries. Intriguingly, this situation presents two challenges on a conceptual level. These challenges are: 1). how to think about knowledge and work in a distributed fashion and, 2) how to account for the social and cultural features of performance. As described below, social features become relevant as performance is essentially a collaborative and distributed practice across specialized work units; likewise, cultural features become relevant as coordination cuts across occupational identities and boundaries, defined, for example, by status in the organization (military vs. civilian) and functional role in the end-to-end process (primary maintainer vs. first-line support). My challenge has been to try to address these issues from the perspective of a performance technologist.

Taking Account of Distributed Knowledge and Work

Interestingly, knowledge, work, collaboration, and culture come into play in this scenario of distributed knowledge and work. This effect has motivated an exploration of alternative frameworks for analyzing performance. My inclination is that conventional views from behavioral psychology and cognitive information processing conservatively think about knowledge as an *object*, something to be codified and transmitted independent of context. Consequently, when HP technologists prescribe interventions with this perspective in mind, they tend to focus on ways to support for this transfer. Moreover, the recipient of treatment is often the individual in isolation. Examples include textbook cases, job aids, intelligent tutoring systems and web-based training. The shortcomings of these traditional views and approaches are that they do not easily permit for 1) the conceptualization of knowledge as a process in social context and 2) the development of interventions at levels of organization that inevitably encounters cultural and institutional elements.

View of Knowledge	Level of Intervention: Individual	Group	Organization
Object	*Cell 1* Computer-Based Training Self-Directed Learning Classroom Instruction Job Aids Cases	*Cell 2* Electronic Performance Support Systems Groupware Learning Objects Distance Support E-Learning	*Cell 3* Business Process Re-engineering Process Improvement Knowledge Management Systems (Technical-Object View) Competency Modeling Organizational Storytelling
Process	*Cell 4* *Apprenticeship* *Mentoring* Coaching On-the-Job Training	*Cell 5* Action Learning *Communities of Practice* *Computer Supported Collaborative Work (CSCW)* Role-plays & Simulations	*Cell 6* Socio-Technical Systems *Knowledge Management Systems (Social-Process View)* Balanced Scorecard Constellations of Practice

Table 1. A scheme for proposing alternative frameworks for analysis.

Within each cell are interventions drawn from a specific theoretical orientation, denoted by the **view of knowledge** and intended **level of intervention**. For example, c*omputer-supported cooperative work* draws from *activity theory* while *knowledge management system (social-process view)* draws from *institutional theory*. Adapted from original work by Kalman and Schwen (2000).

To counter, I have juxtaposed three perspectives—*communities of practice*, *activity theory*, and *institutional theory*—that more readily permit for the kind of analysis and design anticipated. Getting bogged down in theoretical abstractions is not the purpose. On the contrary, my position is that these theories lead to intervention options not available in the conventional HPT toolkit. To this end, Table 1 provides the backdrop for an exploration of alternative views and subsequent interventions. Basically, my argument runs likes this: "If increasingly we encounter organizational problems where *groups* are working together collaboratively on a knowledge-intensive *process*, then it may be beneficial to explore and incorporate alternative perspectives that permit attendance to previously overlooked features of organization."

Communities of Practice

From a communities of practice (CoP) perspective knowledge and work occur inseparably from the social, situated contexts of organization. A relevant conclusion drawn is that if knowledge and work are conceptualized as an act of belonging to and participating in a community, then *identities* (occupational, not personal) should be key vehicles by which one comes to know a practice. Interestingly, Wenger (2000) maintains that identity is crucial to a social learning system for three reasons. First, identities combine community-defined competence and individual experience into ways of knowing. Second, one's ability to deal productively with community boundaries depends on an ability to engage and suspend identities. Finally, identities are the living vessels in which communities and boundaries become realized as an experience of the productive world.

Noticeably, identity as a concept is crucial in this project as sailors and civilians interact on demand to accomplish complex, orchestrated tasks. Although members of each community can be labeled 'technician,' the knowledge they offer and which is made available by the community differentiates, rather than integrates identities. Identity, then, can be seen as a social feature of organization that impacts performance.

Activity Theory

According to the principles of activity theory (Engeström; 2000), an *activit*y is a coherent, stable, relatively long-term endeavor directed toward an identifiable *object*, or goal. Within the fundamental activity system, a *subject* (individuals, groups, or other activity systems) use *tools* to achieve this goal. For instance, sailors use technical manuals, electronics terminology, and measurement instruments to complete the goal of troubleshooting a piece of gear or equipment. Moreover, an activity can be understood only within its culturally situated context, defined by the *community*, the *rules* they enact, and the *division of labor* they enforce. Interestingly, one area where activity theory differs noticeably from communities of practice is the emphasis of tensions, or *contradictions*, that arise within and among activity systems.

Within the Navy case, a principal concern is with contradictions that arise between sailors and civilians along lines of identity, knowledge, and community membership. One clear tension exists between obligations sailors have toward the Navy and toward the 'technician' community. A challenge here for HPT is to determine how best to handle these tensions because, from an activity theory perspective, contradictions can at times spur learning and innovation.

Institutional Theory

Institutional theory (IT) is the third perspective to add value to this analysis. Two constructs found in IT especially attractive are *power* and *meaning*. That is, institutions, when 'taken-for-granted' exert power on social actors by legitimating structures, rules, and procedures. In contrast, meaning is the method by which actors change institutions by specifying innovations then justifying them by appealing to legitimacy (Scott, 1995).

From analysis, one instance of conflict found between power and meaning involves the training and development of sailors. Whereas the Navy as an institution exerts power to establish the right blend of sailor and technician in a recruit, sailors themselves instill meaning into the role of *sailor-technician* by creating mechanisms (such as 'refresher courses') to maintain what is perceived as the required balance.

In summary, communities of practice, activity theory, and institutional theory together bring fresh insights to the problems faced by HP technologists when contemplating KM ideas and initiatives. What follows is a case of distributed knowledge and work within this context.

Troubleshooting a Fault: A Case of Distributed Knowledge and Work in the U.S. Navy

In the U.S. Navy *Electronics Warfare (EW) technicians* are tasked with the operation and maintenance of a ship defense system referred to as the "Slick-32." Put simply, the "Slick-32" acts as a sophisticated radar detector for over 200 ships in the fleet, detecting and identifying any object that enter a ship's operational horizon.

Whereas many prescribed troubleshooting procedures for the "Slick-32" are documented thoroughly there is a certain class of problems that fall outside this sphere. Consequently, these problems, or "faults," often require EW technicians request assistance from a team of waterfront civilian technicians and engineers available to the fleet. One possible limitation on a sailor's knowledge, which would necessitate this request, may be that she is familiar only with the particular system on her ship. Likewise, she may have spent most of her sea duty following precisely detailed procedures that permit little improvisation. What differentiates waterfront, civilian SMEs from sailors are 1) although many have performed military service, they are now classified as "civilians"; 2) they have on average had several more years experience working on all variants of the "Slick-32"; and 3) they have troubleshot any number of "undocumented" or "unidentified" faults over those years. These technicians and engineers, on the other hand, do not possess the detailed knowledge of any one specific system and its unique operating environment prior to a technical assistance request. To contrast the two, when a sailor is troubleshooting her system she is restricted in knowledge by training, the particular ship, and the specific piece of gear. On the contrary, the waterfront technician is able to draw from a rich store of knowledge accumulated from experience. Another way to look at this is to say that the sailors rely heavily upon *explicit*, *organizationally-mandated* knowledge. This knowledge is formalized in the shape of curricula and technical manuals that standardize practice across the enterprise. Technicians, on the other hand, draw from a deep store of *tacit, highly-individualized* knowledge to conduct their troubleshooting work. This knowledge has been gained by working hand-in-hand with hundreds of shipboard work units and their systems. Thus, in this intriguing configuration, collaborative troubleshooting across structural and cultural boundaries is further complicated by a disparity in knowledge types being drawn upon and exchanged.

Potential Interventions from a Knowledge Management Perspective

While a conceptual reframing has been a much needed first step, development of appropriate interventions is the ultimate requirement for this project. Consequently, below is offered a sample of tentative knowledge management strategies and solutions we have come up with. Each item in the list presents a generic KM category first proposed by Earl (2001), followed by project-specific solutions. Table 2 provides a quick reference to see how strategies and interventions have been targeted to each of the three user groups.

What should be kept in mind, though, is that these solutions cannot be pondered independent of the analysis of knowledge and work. That is, occupational *identities*, *contradictions* between work units, and institutional *power* and actor *meaning* should inform any intention to intervene. These concepts are the *context* for the distributed knowledge and work being supported by the following solutions:

Knowledge Bases ("Systemized, Codified Expertise"): capture SME knowledge and make it available to sailors. Codification of engineering know-how, technical expertise, and overall best practices can be accomplished via a Case-Based Reasoning (CBR) system, a High-Performance Knowledge Base (HPKB), and a Best Practice knowledge base.

Knowledge Directories ("Who, What, Where"): record and disclose who in the organization knows what; SMEs throughout the organization are made accessible for advice, consultation, or exchange via Subject-Matter Expert Directories & Profiles and Skills by Experience Matrices offered over an intranet.

Knowledge Flows ("Process Improvement"): unrestricted provision of decision-relevant and contextualized knowledge at point-of-need to increase efficiency, learning, and adaptation; knowledge can be reused at shipboard level via Shared Databases of Logs, After Action Reviews, and Product & Logistical Information, and leveraged at the waterfront level via Shared Databases of 'Customer' Satisfaction Information.

Knowledge Assets ("Rent-Producing"): overtly and explicitly concerned with both protecting and exploiting the Navy's knowledge or intellectual assets to produce revenue streams; "intellectual property" is exploited via Training Curricula, Systemic Expertise and various forms of "Intellectual Property".

Knowledge Pooling ("Networked Communities"): use of technical *and* social structure to exchange and share knowledge interactively as an interdependent network; communities can be designed and maintained to address a specific business purpose via Collaborative Problem-Solving & Support Systems, Knowledge Moderators, Virtual Teams and Discussion Forums.

Knowledge Exchange ("Real and Virtual Spaces"): interaction and discussion promote discovery and exchange of (mostly tacit) knowledge; contact and activity can be facilitated via Virtual Shore-based Tours or Visits, Virtual Break Rooms or Ship Visits, and Virtual Classrooms, Visits or Conferences.

Conclusion

In the end, the goal here has been to offer just one possible path that HP technologists might take to meet the theoretical and practical challenges presented by knowledge management precepts and practices. Thinking about knowledge as a process and contemplating interventions at collective and organizational levels are not easy tasks, especially given our conventional roots. Fortunately, there are emerging perspectives that may greatly facilitate the HP technologists venture into this arena. My suggestion is that we begin to use these, and related theories to inform and improve development.

	Knowledge Bases ("Systemized, Codified Expertise")	*Knowledge Directories ("Who, What, Where")*	*Knowledge Flows ("Process Improvement")*	*Knowledge Assets ("Rent-Producing")*	*Knowledge Pooling ("Networked Communities")*	*Knowledge Exchange ("Real and Virtual Spaces")*
Sailors	Text IR; CBR; HPKB; Concept Maps;	Subject-Matter Expert Directories & Profiles; People Finders; Technical Digests; News; Portals; Information Channels	Shared Databases of Logs and After Action Reviews; 'Electronic Maintenance Activity Support'	Training Curricula; Task Force Excel Maintenance Expertise	Collaborative Problem-Solving & Support Systems; Knowledge Moderators; Virtual Teams; Discussion Forums; Sociable Media	"Virtual Shore-based Tours or Visits"
SMEs	Text IR; Best Practice KBs; CBR; HPKB	Subject-Matter Expert Directories & Profiles; People Finders; News; Portals; Information	Shared Databases of Technical Product & Logistical Information; 'Electronic Depot	Systemic Expertise; "Refresher Courses"	Collaborative Problem-Solving & Support Systems; Knowledge Moderators; Virtual	"Virtual Break Rooms or Ship Visits"
Engineers	Best Practice KBs	Skills x Experience Matrices; News; Portals; Information Channels	Shared Databases of 'Customer' Satisfaction Information; 'Electronic Intelligence, Feedback & Analysis on Equipment & Support Materials'	Commercialization of "Intellectual Property": Production Expertise, Test Sets, Technical Specifications & Manuals; Patents	Knowledge Moderators, Virtual Teams; Discussion Forums; Sociable Media	"Virtual Classrooms, Visits or Conferences"

Technological ⟷ Social

Socio-technical Emphasis of Strategies & Interventions

Table 2. A knowledge management design matrix for the Knowledge Projection Project. Notice that strategies and interventions are aligned along a spectrum emphasizing either more technical or more social aspects of knowledge management.

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The Map is not the Territory: A Constructivist Application of General Semantics to the Design of Educational Texts

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Abstract

Constructivism has had an impact on the field of educational technology. However, an objectivist perspective still dominates much of our practice. To make constructivism a viable approach, we need to develop tools and methodologies to put it into practice. The field of General Semantics has a long history of examining texts from a non-objectivist perspective. As such, it provides us with valuable insight into how we can create educational texts from a constructivist viewpoint.

Introduction

The early proponents of educational technology were influenced by communications theory and were naturally drawn to issues regarding message design. In many ways, it makes sense to think of a particular message one wants to deliver and determine the appropriate medium to carry it. However, as Marshall McLuhan (1964) so famously pointed out, the medium is the message. In the recent history of educational technology, a constructivist philosophy has emerged as a valuable perspective on learning.

In simple terms, constructivists believe that knowledge is constructed, not transmitted (Jonassen, Peck, Wilson, 1999). A constructivist perspective also emphasizes the elusiveness of meaning. To a constructivist, meaning does not exist outside of context. Learners construct meaning as individuals and as groups. The constructivist approach has provided a number of educational strategies. Learning by doing, cognitive apprenticeship, problem-based learning, and computer-based learning environments each embody key principles of constructivism (Duffy & Cunningham, 1996). The educator's role focuses on guiding learners, not telling them. Educational materials are to be viewed as resources, not primary references. It may appear ironic, but the constructivist learning environment contains a multitude of messages that individually would each be suspect.

The adoption of constructivism and the development of multimedia cannot be considered independent of each other. Multimedia can present multiple perspectives in a multitude of ways. Multimedia encourages constructivism, as constructivism provokes multimedia. Despite the fruitful marriage, text continues to serve as a primary mode of communication. Hypertext extends and bends meaning, but the words remain the same. We may think as constructivists, but continue to write as objectivists.

General Semantics

Fortunately, an entire field of study, General Semantics, addresses the meaning of words and texts from a post-objectivist point of view. The birth of this field of study is usually attributed to the publication of Alfred Korzybski's "Science and Sanity" (1933). In this text, Korzybski describes the difficulties in using written language to refer to anything outside of other words. It also contains his oft quoted, rarely cited admonition that the map is not the territory. Constructivists can take his message to heart. If General Semantics and constructivism share similar philosophies, it follows that they also share tools and methodology. In this document, I provide thirteen guidelines for creating constructivist texts, along with a brief rationale for each guideline.

Thirteen Guidelines for Creating Constructivist Texts

1. Focus on structure and relationships.
   General Semantics teaches us that words can mislead. Words are used to describe the world, but one must remember that words are not the world. Critics of this worldview see a sort of nihilism in this distrust of words. "Those persons who claim that knowledge is founded on collaboration rather than empirical science, or who claim that all truth is relative, are not instructional designers." (Merrill et al., 1996, p. 6). However, Korzybski (1933) explains that words in isolation lack meaning, but that words in context can convey meaning. To that end, he suggests that the relationships between words and the structure of words tell us meaningful things about the world we live. As such, constructivist texts must avoid the perceived need to define terms (e.g. "constructivism is…") and instead focus on the relationships among words and

the structures they imply. A common dictionary illustrates this concept. Each word stands as an equal to all others and meaning emerges from the multiple interrelationships of words, not a reduction to smaller units or a dependence on first principles.

2. Make context explicit.
In an effort to reduce bias, textbook editors have limited the words or examples used in "acceptable" texts (Gladstone, 2003). As many critics have pointed out, this has only introduced a different kind of bias. Bias cannot be eliminated, because every text exists within a context. Rather than attempting to minimize the effect of context, writers should strive to make the context explicit. With explicit context, readers can more easily identify bias and potential problems with meaning. Korzybski notes that we are bound by time. We see the past through our own filters and those of others; the future cannot be known. We only experience the now. Our texts represent this. A map is not the territory, but it can illustrate the context in which it was made.

3. Make the author(s) of texts explicit.
To continue with the map metaphor, a map not only attempts to describe a territory, but also describes the biases and worldview of the mapmaker. Likewise, a text illustrates the worldview of the author. It is not possible to include all worldviews. And as many critics of "diversity" have pointed out, the desire to include all worldviews represents a particular worldview that is not universally shared. Again, one must not be reduced to a pessimistic outlook. By explicitly stating one's worldview, the reader can compare and contrast that view with his or hers and react accordingly. For example, L. Summers (personal communication, October 8, 2003) used the qualitative technique of portraiture to describe the participants in a novel secondary education program. Prior to introducing the students, she describes her own person experiences as a young learner. The reader can then read her descriptions with a better sense of how the author's experiences have shaped those views.

4. Use quotes to delineate "questionable" concepts.
Ironically, the practice in General Semantics of explicitly quoting individual words to draw attention to their dubious meanings has become a widespread practice among those that may have no knowledge of the field. Whether quoting in text or indicating quotes in the air during verbal communication, the gesture can be used and understood to indicate that the quoted word or phrase may not indicate what it purports to indicate. A challenge for authors is to increase its practice in "formal" texts.

5. Use "et cetera" and other devices to indicate the limitation of a particular description.
Another easily understood mechanism is the use of "et cetera" or "etc." to indicate that a finite list is not an all-inclusive list. From the perspective of General Semantics, the period as a form of punctuation can imply a finality that is not intended (Kodish & Kodish, 2001). When presenting examples, or other enumerations, the frequent use of "etc." will remind the reader that the author has not completely mapped the territory described.

6. Use multiple representations.
Words provide one type of representation. Pictures provide another. Graphs provide a third. Korzybski (1933) was particularly drawn to graphics because of their ability to represent structure and relationships. Multiple representations provoke readers to compare and contrast the concepts illustrated. As such, a constructivist text would be best served by providing at least two, but possibly more representations of any topic. Although work in General Semantics appears to focus on text, any symbol system can cause the same types of problems as misleading text. Our current "comfort" with televised images and instant access to information has introduced many of the same misconceptions that we have only recently begun to appreciate in text.

7. Use metaphors.
Teachers and interface designers use metaphors to connect with learners. However, metaphors have been criticized as being too limited (for example, Nelson, 1990). From a General Semantics point of view, the importance of metaphors as abstractions is that they are obvious abstractions. In contrast, technical writing and "dry" text fool the reader in believing that they are "literal" descriptions of reality, without the nonsense of abstraction. Readers are generally comfortable with discarding metaphors when they have

outlived their usefulness. I would suggest that those same readers would often cling tenaciously to an abstract definition, despite the problems it may cause.

8. Avoid absolutes.
The nature of absolutes can be illustrated by the following example. An instructor produces a small empty jar and a larger jar filled with marbles. She then pours the marbles into the smaller jar until it is filled and asks the class if the jar is full. There may be some discussion where the top of the jar ends, but the students will eventually conclude that the jar is full. At that point, the instructor produces a jar of sand and effortlessly pours a large quantity of sand into the "full" jar. This can be done again with another jar of water. The point of the experiment is that the seemingly simple concepts of "full" or "empty" are bound by conditions and assumptions (the reader should note that it is not difficult to show that the "empty" jar at the beginning of the experiment was actually "full" of air and that despite being "full" more air could be forced in to the jar). Although the author should attempt to make conditions and assumptions explicit, avoiding the unnecessary use of absolutes will increase clarity.

9. Avoid either-or formulations.
Although we continually remind ourselves not to think in "black or white" or that a particular characteristic can be viewed on a continuum, either-or writing becomes a hard habit to break. A familiar example is "quantitative" versus "qualitative" research. The "natural" assumption is that quantitative research lacks quality and that qualitative research lacks quantity. If distinctions were necessary, it would be better to talk about quantitative-qualitative research and qualitative-quantitative research to indicate that both "types" contain similar attributes, but with different foci.

10. Avoid the passive voice AND make the actors visible.
Many writing instructors suggest avoiding the passive voice. General Semantics makes the suggestion with a very specific criticism: the passive voice hides the actors. Consider the following examples, "I wrote these guidelines after reading a number of sources on General Semantics." compared with "These guidelines were written after the consultation of a number of sources on General Semantics." In the first example, the author's role in creating the guidelines is clear. The second example is more formal, the passive voice puts the guidelines first and the author's role in their creation is minimized.

11. Avoid the "is" of identification.
The problematic use of "is" has led some semanticists to suggest that it be eliminated entirely from the language (Kellogg, 1993). For our purposes, it should suffice to address some of the concerns. A first problem with "is" concerns misuse regarding identification. If a writer states "Bob is a liberal," the reader is expected to believe that the world consists of "liberals" and "non-liberals" with individuals neatly classified into each. However, there is no litmus test to achieve this. If the writer proposes one, the classification becomes conditional upon that framework. This can be avoided by avoiding the "is" of identification. If the writer is concerned with "Bob's voting record" or "Bob's writings on economic theory," it can be done without errors in identifying Bob.

12. Avoid the "is" of predication.
A related problem is the "is" of prediction (Chalip, 1969). By stating, "Joe is bad" a teacher has freed himself from higher-order abstraction. An analysis of that thinking would reveal "he believes that Joe is bad because he is disruptive in class." He can then conclude that Joe is not "bad," but Joe is engaging in behaviors that are disruptive to the class. From that perspective, a teacher can help Joe in reducing his disruptive behaviors rather than continuing with a false label. The distinction of individuals and behaviors has contributed to greater understanding in counseling situations.

13. Provoke readers to question assumptions and question questions.
Readers construct meaning. A constructivist text challenges the reader to not accept the words as "truth" as a matter of authority of the author. This does not mean that everything is permitted. As with any scientific endeavor, empirical or not, truth is provisional and subject to revision. Readers should be encouraged to test the conclusions of any text and expand upon it. Not only should the questions raised by the text be answered, but also the nature of the questions questioned. As the title of Korzybski's (1933) text suggests, science AND sanity are required to further human knowledge. General Semantics does not replace science,

but rather supplements it with understanding about the nature of language.

14. Et cetera.

Conclusion

Educators and instructional designers that are involved in the creation of texts would benefit from the work done in General Semantics. General Semantics is not a panacea (I leave as an exercise to the reader, the identification of the various errors I have stated that exist in this text). However, it can be taught to students through relatively simple activities (for example, see Maas, 2002). The practice of these guidelines is like a good habit. A little is good and leads to more crisp writing. When it becomes more natural, the result is more crisp thinking. Hopefully, constructivists will add these useful tools to their toolboxes.

Those readers interested in learning more about General Semantics can begin with the following resources:

- Any serious academic inquiry into General Semantics must begin with Alfred Korzybski's "Science and Sanity" (1933). Its size (927 pages) and academic tone can be daunting to some readers, but it is the singular source from which the field emerged.
- A less academic introduction to General Semantics can be found in "Drive Yourself Sane: Using the Uncommon Sense of General Semantics" by Drs. Susan and Bruce Kodish (2001).
- The most well known journal devoted to General Semantics is "ETC: A Review of General Semantics" published quarterly by the International Society for General Semantics.
- A wealth of information can also be found at the websites of the International Society for General Semantics (www.generalsemantics.org) and the Institute of General Semantics (www.general-semantics.org).

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A 4-D Online Teaching Program Model

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Abstract

The Teaching and Learning Department at Virginia Tech has offered an online Instructional Technology Master's Degree program (ITMA) since 1998. A 4-D online teaching program model is generalized from the perspective of an ITMA designer and grader based on her ITMA experience. The 4-D model consists of 1) First dimension-X Coordinate: Inside system. 2) Second dimension-Y Coordinate: Outside system. 3) Third dimension-Z Coordinate: Leadership and 4) Fourth dimension-Time: Continuous system.

Introduction

The Department of Teaching and Learning at Virginia Tech began to offer an online Instructional Technology Master's Degree program (ITMA) in 1998. As a distance program, all the courses are offered online with the support of Blackboard and ITMA database system, accompanied with tutorials, textbooks, and CDs. With the success and growth of the program, the students have expanded from K-12 educators to corporate trainers and other educators outside the academic field.

Since the courses were put online, the instructors had little involvement with the course delivery. A full time faculty member acts as a director and leads the whole program. Several doctoral students work under the director, responsible for the design, coordination and grading work. These students are at least in their second year doctoral study in Instructional Technology program.

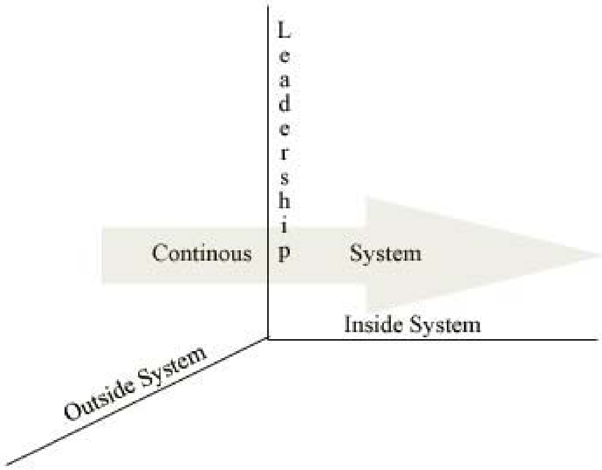
Most of the ITMA students are part time students. They take the online courses when they work on their jobs. For most of the courses, there are few required due dates for the assignments. Most of the due dates are suggested with the consideration of the distance learners' characteristic – their time is not fully devoted to the learning. They need more freedom to control their own learning pace.

Every registered student gets some free space on the filebox server offered by Virginia Tech. They can request more space if they need. They are required to put their ITMA assignments in their filebox and submit the assignments online. There is specific ITMA online student interface for the learners to submit their assignments. After the learners submit their assignments, the graders can access the submitted assignments via the graders login page and grade the assignments. The grades are automatically stored on the ITMA servers and posted online. The learners can access to their grades and graders' feedback/comments via the web page with their user name and password. If they have questions concerning the assignment, the grades or some technical issues, they will contact the director, the coordinator or the graders via email or sometimes, by phone.

Actively involved in ITMA program, we have lots of contact with the online learners and understand the ITMA internal working system and the external working system. The interaction and the experience help us to generalize a 4-D online teaching program model, which consists of 1) First dimension-X Coordinate: Inside system. 2) Second dimension-Y Coordinate: Outside system. 3) Third dimension-Z Coordinate: Leadership and 4) Fourth dimension-Time: Continuous system.

4 – D Model

Figure 1. 4 – D Online Teaching Program Model



First Dimension-X Coordinate: Inside System

The inside system of an online teaching program is the basis of the program, which includes the personnel resources, the financial resources, the hardware and software resources, the intelligence resources, the internal technical and logistic support, the organization of the system and the cooperation and utilization of different internal resources. Without strong inside system, any online teaching program will not succeed, even though it can be launched at the very beginning. Take ITMA as an example, it has funding resources as the financial support; well-equipped computer lab offering good software and hardware environment; efficient leadership to guide the program; full-time faculty member and doctoral students working for the program and good cooperation among the personnel involved in the program.

Second Dimension-Y Coordinate: Outside System

The outside system is the environment of an online teaching program. A friendly environment will help to strengthen the program. On the other hand, a poor environment will definitely undermine the development of the program. The outside system includes the institutional cooperation, the social recognition of the institution, the general attitude towards the online teaching program, the student resource, external technical and financial support and so on. The outside system has different levels, for example, the international level, the national level, the regional level, the community level, the institutional level, the learner level, etc.

Third Dimension-Z Coordinate: Leadership

To keep running a successful online teaching program, leadership is the key. Good leadership will help to organize the teaching program, build up team cooperation, set up flexible policy and coordinate the internal and external system. Take ITMA as an example. With the increasing number of courses offered and expanding student body, ITMA's success comes from its effective leadership and the team cooperation developed by it. The department Chairperson believes in the future of the IMTA program and continues to support it. A full-time faculty member was appointed as director to manage the program. He devotes most of his time to the program, builds up the rapport relationship among the inside system and coordinates the relationship with the outside system. Everyone in ITMA has clear responsibility and reports to the director. The communication channel is smooth and the team members are empowered. Small problems are directly sent to and taken care by the right person who is responsible for them. Big concern is brought up at the weekly meeting and discussed together. The decision is made on the basis of the learners' interest and the institutional requirement. All of these come from the leadership and contribute to the success of ITMA program. Without the effective leadership, nothing could be achieved.

Fourth Dimension-Time: Continuous System

An online teaching program is different from an online course. It is a systematic enterprise, which needs long-term investment and continuous effort. There is some kind of misunderstanding toward online teaching program. Someone simply takes it as a one-time behavior of wrapping the course contents into Blackboard, WebCT or other software package, which is totally wrong. To initiate an online teaching program needs large amount of investment, such as hardware investment, software investment, personnel investment, technical support, etc. And to maintain the program needs even more efforts. Without the continuous effort and support, the investments will be largely wasted and there is no way to get the full out of the initial effort.

The 4-D model is generalized from the successful experience of ITMA and also has a general application sense for other online teaching programs. With the continuation of ITMA practice, more and more experience will be generalized and contribute to the development of online teaching program model.

Development of an Undergraduate and Graduate Program in Instructional Technology: A Comparison

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Abstract

This paper will discuss the authors' experiences in developing and implementing an undergraduate and graduate program in Instructional Technology in the Department of Instructional Technology and Telecommunications (ITT) at Western Illinois University (WIU). The emphasis of this paper is to compare and contrast the unique nature of the undergraduate and graduate programs.

Introduction

Instructional design and technology skills are becoming essential in a variety of settings. The future of education, business, and industry rests in the hands of those who can use technology to provide the training necessary for continued growth and success. Nearly every organization, large and small, is engaged in ongoing instruction and training to maintain its competitive edge and to keep employees productive and up-to-date. As the need for training, continued education, and professional development grows, so does the need for expert personnel with Instructional Technology (IT) skills.

Brief History and Background

For many years WIU offered an undergraduate degree in Photography/Media. In 1996 it began offering its first Masters degree in Instructional Technology. In 1997 WIU began offering an undergraduate degree in Instructional Technology and Telecommunications. During the last five years both the undergraduate and graduate programs have grown dramatically.

The ITT Department at WIU now has a total of 114 undergraduate students enrolled in its undergraduate program and 190 enrolled in its graduate level program. The majority of the undergraduates obtain jobs in the corporate world as web-designers, multimedia producers, performance specialists, and trainers. At the graduate level, the majority of our students are public school teachers seeking a Masters degree to provide them with technology skills to use in their classrooms and schools. To date, 130 students have graduated from our Masters program in ITT. The ITT Department maintains a very high placement rate of undergraduate and graduate students, with graduates holding positions at various levels of industry, government, and education.

The ITT Undergraduate Program

The ITT Department seeks to develop in undergraduate students the ability to apply new and existing technologies to solving educational problems in a wide variety of instructional settings including schools, business, industry, and government. Students accomplish the program's objectives by learning to design, develop, and evaluate effective, efficient, and appealing instruction, instructional materials, and information resources. The Bachelor of Science degree in ITT places an emphasis on providing students with both the technical skills, including training in the latest computer technology and applications, and the teamwork skills necessary to manage people and projects. Several of the students who decided to major in ITT were computer science majors that switched to ITT because they wanted to work with software applications (such as Director, Authorware, Photoshop, etc.) rather than program code.

With an emphasis on hands-on experience, teamwork and real-world applications, WIU's ITT program is practical and flexible to support student's individual career goals. Most of the undergraduate classes in the program are project based. In most of the classes our students have to work in teams to complete instructional technology projects. All projects they complete become part of their portfolio, which is a requirement for graduation.

The ITT Graduate Program

The ITT Department seeks to develop in master's degree students the ability to apply new and existing technologies to achieve educational goals in a wide variety of instructional settings including, but not limited to, schools, industry, government, heath-related agencies, and institutions of higher education. Students accomplish these objectives by learning to design, develop, and evaluate effective, efficient, and appealing instructional materials.

In their course of study, students in ITT have opportunities to acquire conceptual and hands-on experience with effective teaching, learning, and collaborative design and development of professional instructional materials. In addition, internships, projects, and practicums provide students with chances to apply their skills in real-world settings both on and off campus.

ITT Department Philosophy

The ITT Department's conception of teaching and learning is based on a constructivist philosophy. According to constructivism, knowledge doesn't exist external to the learner. Rather, individual learners construct their own meanings based on their prior experiences. Learning is a result of construction, collaboration, reflection, and negotiation within a rich context in which learning is situated. Technology has the potential to support constructivist learning and be used for active, authentic, and cooperative activities. Knowledge building results when learners interact with their peers, collaborate, discuss their ideas, form arguments, and negotiate meaning. When used appropriately, technology provides a more decentralized environment where students take more control of the learning environment and become active constructors of knowledge while working on authentic tasks. The role of the teacher has shifted from knowledge transmitter to that of a facilitator who provides opportunities for interaction and meaning making to all learners. The use of technology and cultural tools to communicate, exchange information, and construct knowledge is fundamental in constructivism. Strategies for teaching and learning are not chosen to facilitate transfer of knowledge from the world to the learner's head, but to provide tools the learner will use to create meaning.

Comparison of the Undergraduate and Graduate Programs

Superficially, there seem to be quite a number of similarities between a graduate IT program and its undergraduate cousin. However, we have also found subtle differences. Following are some points of comparison that may help to highlight the obvious (and sometimes not so obvious) differences:

Specific objectives and focus of each program. As described above, the graduate program is primarily focused on instructional design while the undergraduate program is focused on instructional development and production.

Nature of the students in each program. The majority of graduate students come from educational settings. The majority of undergraduates plan to work in business and industry settings. Undergraduates are often more interested in developing instructional materials, they are less interested in designing instruction. They have also expressed preferences for production work, rather than project management.

Establishing internship opportunities for students. Many of the organizations that offer Instructional Technology internships require students to be enrolled in a Master's degree program. There seems to be a clear bias among some instructional technologists responsible for administering company internship programs that students need to be working on a Masters degree in instructional technology to be qualified for an internship opportunity. It is more difficult for undergraduates to obtain an internship experience.

Obtaining job interviews. Some companies make it very clear that job qualifications require a minimum of a Masters degree. Many organizations are not aware that undergraduate programs in IT exist. Its relatively easy for graduate students to obtain that elusive job interview. Undergraduates, on the other hand, seem to have a bit of an uphill battle. In addition, because undergraduates are often are production oriented, they sometimes interview for positions outside of the IT field.

Student interest in developing good instruction. Because most graduate students come from an educational background, they are very interested in learning methods and techniques for developing 'good instruction.' In contrast, some undergradute students are not really interested in developing effective, efficient, and appealing instruction, but rather are more interested in working with specific software applications on the computer.

Benchmarking. It is difficult to do any benchmarking on the undergraduate program because there are so few programs available at an undergraduate level. While its relatively easy to compare the graduate program to other similar programs, the undergraduate program has few resources available to determine what should be expected or what should be considered standard.

Keeping software and equipment up-to-date. Since the undergrade program is primarily focused on instructional development and production and courses are primarily project-based, undergraduates expect to use the latest and most effecient software/hardware. They seem to recognize implicitly that the potential jobs are directly tied to staying current with the latest software versions. Some graduate students feel the same way. (Usually those who are more production oriented or business/training types.) However, the majority of graduate students (especially those with education backgrounds) do not seem to demand the 'latest and greatest' software. It is difficult to keep current software applications and up-to-date hardware available.

Does an undergraduate program work?

Recently, Gustafson (2001) contacted many major instructional design and technology programs in the U.S. and asked them about establishing undergraduate IT degree programs. He found responses to such questions were almost universally negative. Evidently, faculty in many IT programs have very little desire to establish an undergraduate IT degree. He listed several reason for their reluctance. We thought it would be instructive to use these objections as a springboard for discussion.

Lack of resources Lack of resources to expand programs is an important issue at most universities. Recently many states have initiated a series of budget cuts that impact their universities' bottom line. A new degree program can often be seen as a real resource drain, in terms of additional faculty, expanded office, classroom, and laboratory space, additional equipment, and operating supplies. At WIU, these issues were addressed and it was realized that if allowed to grow at the right pace, an undergraduate program could be an efficient enhancement to the graduate program. For example, laboratory space is more efficiently used, and faculty have access to undergraduate talent who's production skills are often remarkably good. In fact, the undergraduate talent pool has been an added resource not previously available to the College of Education and Human Services (the College within which the ITT Department is located).

Belief that it would result in extra work Gustafson (2001) found that many faculty believe that undergraduate programs are more labor-intensive than graduate programs. Experience shows that it often takes intensive advising in order to keep undergraduates on track for graduation. And undergraduate degree programs must be carefully integrated with other departments in order ensure that general graduation requirements are met. Our experience has bourn this out. It's been quite difficult to keep courses scheduled so that undergraduates can get the courses they need in a timely manner. Also undergraduates simply do not display the level of emotional and intellectual maturity that graduates do. Intense advising is often necessary.

Undergraduate credit hours are worth less Some institutions give higher value for teaching graduate classes. For example, student credit hour production may be calculated differently, with graduate classes receiving a much higher weight. Consequently, an undergraduate program may need to have many more students enrolled in classes, just to make up for student credit hours. At WIU, there are slight differences in how graduate classes are valued against their undergraduate counterparts. However, these differences are negligible.

No incentives from the university Faculty may be reluctant to embrace an undergraduate IT program when they feel there is no incentive from the university for doing so. Some faculty may feel that an undergraduate program is less prestigious. Others may feel that they should be compensated at a higher rate since undergraduates require extra work. WIU's ITT program is structured so that faculty teach both graduate and undergraduate courses. Also, the University and College of Education and Human Services fully support the instructional technology program. This provides quite a bit of incentive.

Belief that no undergraduates would enroll It might seem that students would be reluctant to enroll in an undergraduate IT program. However, our experience has been quite the opposite. The growth of undergraduate program at WIU has far exceeded initial projections. Students from all different disciplines seek out and enroll in the ITT program. Undergraduates exhibit a very high degree of interest in multimedia and technology.

Belief that there are no jobs for program graduates Some companies make it very clear that job qualifications require a minimum of a Masters IT degree. In addition, many organizations are not aware that undergraduate programs in IT even exist. As Gustafson (2001) pointed out, this is a real supply and demand conundrum. If there is little to no supply of graduates, its hard to raise awareness in potential employers. Despite this concern, graduates of the ITT program have done remarkably well in finding jobs. Since undergraduates are often are more production oriented, many find positions outside of the traditional IT field. However, they still end up using the technology skills they learned in ITT. And, as an added bonus we often get feedback from graduates out in the 'real world' who tell us how relevant their training is to their current job.

Concern for possible negative impact on existing graduate programs Some faculty might be reluctant to embrace an undergraduate IT program because it may negatively impact a well established masters program. For example, if the knowledge and skills currently taught in masters programs were now being offered to undergraduates, then the masters programs would need to be modified (so that they would not be redundant). Our experience shows that there is some truth to this uneasy feeling. There are occasions, when our undergraduates have had a hard time seeing the difference between their coursework and that of the graduate program. On other occasions, employers of our undergraduates find it hard to believe that they only have a B.S. degree.

Conclusion

While on the surface there are many similarities between a WIU's graduate and undergraduate programs in ITT, there are still many differences as well. Both programs strive to give students opportunities to acquire experience with effective teaching, learning, and collaborative design and development of professional instructional materials. Internships, projects, and practicums provide both graduate and undergraduate students with chances to apply their skills in real-world settings both on and off campus.

There are however, important differences in both the demographics of the two student populations, and in the objectives of the two programs. In terms of students, the undergraduate degree appeals to more production oriented, technology savvy students. The graduate program, on the other hand, generally appeals to students involved in public education and/or business training. This is probably due to the fact that, the two programs have slightly different orientations. As described above, the graduate program is primarily focused on instructional design while the undergraduate program is focused on instructional development and production.

We believe that the conditions are favorable for establishing undergraduate programs in instructional technology. First, nearly all organizations, large or small, are engaged in the business of instruction and training. Second, in this information age, business organizations simply must address training to maintain their competitive edge and to keep employees productive and up-to-date. As Gustafson (2001) stated, "The current and projected future demand by business and industry for skilled instructional designers far exceeds the current and projected supply" (p.61). As the need for training, and professional development grows, so does the need for individuals with instructional technology skills. We feel that undergraduate programs in IT will help fill the gap and provide program graduates with the knowledge, skills and abilities to serve this growing need.

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Developing a Community of Practice across Face to Face Undergraduate and Online Graduate courses

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Abstract

A collaborative project was implemented to provide project management experience for a group of graduate students in an online project management class and undergraduates in a face-to-face project management class. The graduate students role-played as instructional developers of a project for a client. The undergraduate served as subcontractors to the graduate students. The focus of this study was to explore the development of a community of practice across an online class and a face-to-face class.

An undergraduate and a graduate class on instructional project management were offered during the same semester by the Instructional Technology Department at a U.S. state university. The graduate class was an online class; the undergraduate course was conducted in a face-to-face classroom, with Web-based support via BlackBoard.

A simulation was developed where the undergraduates represented the Web developers and the graduate students represented clients who were working on a web redesign. Undergraduates worked first as competing teams to submit proposals. Once the winning proposal was chosen, the undergraduate worked as a team with subgroups to work on the project. Feedback was collected on the simulation from the undergraduate and graduate students.

This paper presents the results of this study and the lessons learned. The critical issues will include the role of authenticity in developing a community of practice, the function of role-playing simulations in instructional project management training, and collaboration across online and traditional classes and across graduate and undergraduate classes.

Introduction to Study

Instructional project management is a complex discipline requiring a broad range of skills. Today's workplace is increasingly requiring instructional project management skills of instructional designers. Evolving technology is causing the project elements to be managed to be even more plentiful, frequent, and diverse. Communication challenges become more demanding as management occurs over distances rather than at one location (Litchfield & Keller, 2002). Effective communication is at the heart of skillful instructional project management.

Devising methods to teach these important skills effectively can be a challenge. It is essential for later transfer to job performance that the job context be integrated into learning (Clark & Mayer, 2003). For this reason, the authors chose to provide their students with the same experiences that they would encounter in the working world, supplemented with group interaction and coaching.

The Instructional Technology and Telecommunications (ITT) Department at Western Illinois University offers an undergraduate B.S. program and a graduate M.S. program. In response to an increase in students who are site-bound or working full-time, ITT has begun shifting its traditional graduate classes to online classes. About 80% of the graduate courses are now offered online.

This presents a problem for facilitating collaboration and mentoring between undergraduate and graduate students. In the past, graduate students could come into the undergraduate classes and work directly with the undergraduates. However, this was mostly handled by graduate and teaching assistants.

In Spring of 2003, the graduate instructional project management course (ITT565) was converted from a F2F classroom to an online course. At the same time, the corresponding undergraduate course (ITT 330) was being offered in an electronic classroom that offered videoconferencing. Due to the cost of videoconferencing, this method of communication could not be offered very frequently.

Nevertheless, it was felt that this situation offered a unique opportunity for trying a model for online collaboration between the two groups.

The graduate students role-played as instructional developers of a project for a client. The undergraduates served as subcontractors to the graduate students.

A team of students from the graduate class developed a request for proposal (RFP) for the development of media assets for an instructional website. Teams of undergraduates responded to the RFP with their own proposals. The graduate team selected the best undergraduate proposal. All of the face-to-face undergraduate class worked on completion of the winning project.

The communication process used face-to-face planning sessions, teleconferences, synchronous online discussions, and asynchronous discussions. Undergraduate students were able to play various roles in the project management process. Both the undergraduate teams and the graduate team were able to gain experience in negotiating with a client. The graduate students developed communication skills for managing projects when the various stakeholders are at a distance and telecommunication is essential.

Background on Collaboration

The cognitive apprenticeship model (Collins, Brown, & Newman, 1989) has been used in online mentoring models (Dorneich & Jones, 1997) to encourage the development of mentoring online. Numerous studies have documented the use of graduate students for the mentoring of undergraduate students (Russell & Daugherty, 2001; Koals, 2000). Similar models have been used in the context of having in-service teachers mentor preserves teachers via the Internet (Seabrooks, Kenney, & LaMontagne, 2000).

A community of practice can be somewhat difficult to develop and maintain in online classes and even traditional classes (Dorneich & Jones, 1997). This is especially true with hybrid configurations where part of the students meet face-to-face and other students are online and meeting in asynchronous discussion groups.

Another challenge is trying to develop a cognitive apprenticeship program across graduate and undergraduate students (Russell & Daugherty, 2001; Koals, 2001). This process involves finding a common project or projects with appropriate levels of mastery for the students (Clark & Mayer, ibid). This paper will present a study that addressed both of these issues.

Description of Study Design

An undergraduate and a graduate class on instructional project management were offered during the same semester by the Instructional Technology and Telecommunications (ITT) Department at Western Illinois University. The graduate class was an online class authored on BlackBoard; the undergraduate course was conducted in a face-to-face classroom, with Web-based support via BlackBoard.

The undergraduate class consisted of younger students in their junior and senior years of study. They had considerable experience in multimedia and online production, but little experience in real-world project management. The graduate students were considerably older, and most had at least several years of work experience. They had more training in instructional design and project management than the undergraduates, but somewhat less experience in most cases in multimedia production.

The instructor of the undergraduate class was the on-campus chair of the ITT department. The adjunct instructor of the graduate class was an experienced project manager of instructional and multimedia projects, a doctoral student, and remotely located. It was not feasible for her to come to campus or meet her students face-to-face, most of who lived at a distance from the campus.

It was decided by the two instructors of these classes to see:

- if a community of practice could be developed across a hybrid instructional delivery system and
- if a cognitive apprenticeship model could be used with graduate and undergraduate students.

A team of graduate students role-played as instructional developers of a project for a client, the ITT department. The undergraduates served as subcontractors to the graduate students.

A team of students from the graduate class developed a request for proposal (RFP) for the development of the university departmental web site. Teams of undergraduates responded to the RFP with their own proposals. The graduate team selected the best undergraduate proposal. All of the face-to-face undergraduate class worked on completion of the winning project.

The communication process used face-to-face planning sessions, teleconferences, synchronous online discussions, and asynchronous discussions, both within and between the graduate and undergraduate teams. Undergraduate students were able to play various roles in the project management process. Both the undergraduate teams and the graduate team were able to gain experience in negotiating with a client. The graduate students developed communication skills for managing projects when the various stakeholders are at a distance and telecommunication is essential.

At the end of the collaboration the students were asked to evaluate their experiences. Undergraduate students in the face-to-face class were administered an anonymous questionnaire addressing the following topics:

1) What worked well in this collaborative effort between ITT 330 and ITT 565?
2) What could be improved on for this collaborative approach the next time?
3) How real did the project feel in terms of working for an actual client?
4) Did you feel that you were part of a larger learning community because of your involvement in this joint project?
5) What did the graduate student do to contribute to the sense of community?
6) What more could the graduate student have done?
7) Did you feel like you were part of a learning community during this project?
8) Did you perceive of the graduate student as a mentor or more experienced participant in this project? Why or why not?

The participating graduate student wrote a submission for a class threaded discussion on “what worked and what didn’t” about his experience project managing the development of the instructional web site. He chose to use it as his evaluation rather than filling out an additional questionnaire.

Description of undergraduate task

The ITT 330 students were split into four teams. These teams responded to the RFP developed by the ITT 565 clients. Each team nominated a project manager.

A videoconference was setup for the four ITT 330 teams to present their proposals to the ITT 565 clients. The client and the two instructors rated the written proposals and presentation using a common rubric.

Once the winning proposal was selected, four new teams were selected by the ITT 330 students themselves:

Graphics
HTML
Content
Editing

Each team elected a team leader. An overall project manager was also elected by voting for entire project. This manager met with the team leader to form a project management team. This team was the primary point of contact with the client.

Description of the Online Graduate Task

Since the intent of this course was to provide a forum to learn about managing instructional projects, ITT 565 provided students with guided real world experience as instructional project managers. These experiences took a variety of forms ranging from developing a statewide K-12 online teaching resources portal to producing instructional web sites for college courses, college departments, nonprofit organizations and even a department of the United Nations. Other students developed infrastructure for K-12 technology integration within a school system and “smart classroom” acquisition within a college. The student team who collaborated with ITT 330 was charged with working as project managers with a contracted production agency from the undergraduate class to complete the project of redesigning the university ITT department web site. They had to engage with the client to conduct a needs analysis and generate commercial, creative, technical and content requirements for the web site. They generated an RFP based on these requirements and made their selection of an ITT330 team to do the work based on their judgment of how well they would conduct the work. They had to identify risks and develop a communication plan and management plan for working with the team. Once they had chosen the “agency”, they had to use continuous and effective communication with the agency and client to create a successful project. The required deliverables were:

a project brief
a method plan
an RFP
final project

✓ with management elements provided by the graduate online students including:
    - a revised RFP
    - budget
    - schedule
    - instructional delivery plan®
    - look and feel
    - content outline

✓ with media assets to be produced by the face-to-face undergraduate students with the oversight of the graduate students including:

- graphics templates
- story boards (as applicable)
- site map
- a fairly well realized final product, at minimum a paper or computer prototype

Description of the Graduate Online Class Simulation

The collaboration team began as two students. One was a Master's student employed as a graphics designer and web developer at the main university campus, with extensive experience in client relations and managing self-contained projects (in which she managed her own work but no one else's). The other Master's student was a technical support employee at a remotely located university campus. He was a technical assistant lacking project and management experience. The team did a very successful job of collaborating among themselves, with the client and with the undergraduate students to complete a thorough needs analysis and develop an excellent project brief, method plan and RFP. At the completion of the RFP, the more experienced student dropped the class – and thus the project – citing overextended time commitments. The remaining team member met several times by teleconference with the undergraduate class and the class instructor to consult about the RFP, select the "agency" to be awarded the contract (in conjunction with the instructors), and to develop a schedule for project completion. An agency project manager was chosen. The production agency agreed to establish a production web site for the posting of work as it was completed. The production timeline for completing the work was limited due to semester constraints.

After the production process commenced, work flowed in to the project manager but did not meet its schedule. The graduate online project manager kept in regular touch with his instructor expressing his frustration about lapsed deadlines and unreturned emails. His instructor coached him to be more proactive; she suggested that he (1) establish who was responsible for the content outline and (2) establish regular status meetings via phone call at least once weekly. The student did not implement these suggestions. At the end of the semester, a small portion of the media assets had been implemented, and there was no evidence that the content had been or written or even thoroughly planned for. The final project assignments that were exclusively management-related were completed.

Outcomes for Undergraduate Class

The response to the RFP proceeded very well. There was some frustration in a couple of team members who felt some of the members had not contributed as much or had missed deadlines. Team members were asked to rate their contribution and effort in the team and to rate the other group members. This information was shared only with the ITT 330 instructor. There was a fairly good triangulation of estimate effort by group members, including self-estimates.

As the project shifted into work on the actual project, stress began to increase. Part of this was due to the scope of work and the timeline for the project. It also stemmed from the inherent group interdependence. Project meeting were held to allow different teams to work out conflicts within their groups and between groups. This corresponded with class and text discussion on conflict management.

The ITT 330 project team turned in revisions for the web site, including new graphics, revised site map, new content, and a revised homepage. They also completed an individual survey about the simulation.

The ITT 330 students worked very intently on completion of their assignments. During a relatively short period of time, the students came up with an outline and template for a redesigned website.

Most of the communications occurred within the groups. After the initial two videoconference sessions, there was some email communication between the graduate student and the undergraduates. Most of the communication was between the project managers for ITT 330 and the ITT 565 graduate student.

The ITT 330 students felt fairly rushed by the timeline. Part of the simulation was to learn to negotiate timelines with the client. They corresponded with the student-client and negotiated additional time and reduced tasks.

There were also challenges within the groups. Some of the groups found themselves held up waiting for other groups to finish their work. Team leaders negotiated with other leaders to reschedule tasks and to get updates on deliverables.

Collaboration was not perfect. There was limited communication with the graduate student. The amount of collaboration between ITT 330 groups varied. Some seemed to work closely through their team leaders. Others seemed to work independently.

While such collaboration is possible, it requires more structure than may occur in authentic settings. Many project participants stated that an authentic environment was created but expressed the need for more communication opportunities.

A final foot note to the undergraduate project. Four of the students participated in an internship project working as a team with a real client. The project was a tremendous success, with the client offering to give recommendations to all four students. He also said the quality of the video project was equivalent to projects developed earlier by commercial developers. The students felt the experiences in the simulation helped prepare them for dealing with a client and how to function as team members in a instructional design project.

Outcomes for the Graduate Online Class

This collaboration, though it was not successful in producing all of the assigned deliverables, was successful as a learning experience for the student and as an example for the other students in the class. It provided a contrast to the many class projects executed by students who successfully completed their deliverables, enabling the students to see that a multiplicity of factors need to work together for a project to come off successfully. The success of a project is by no means guaranteed; it often involves the project manager's overcoming –as well as anticipating and avoiding - numerous obstacles. Some of the barriers in this case were the need to manage over distance, an unrealistic time frame for the completion of work, role confusion, and the sudden departure of the more skilled and experienced team member from a two-person team.

In his evaluation of the project, the graduate student wrote that he felt that overall the project had been a good experience. He cited collaborating with his partner to create the RFP and the process of working with the other class and class instructor to consult and evaluate the proposals by the vying "agencies" as positive elements. He also praised several administrative elements, such as the way the other class was broken down into design teams and the fact that there was a design agency project manager for him to interact with. However, he wrote that he felt that more communication and negotiation were needed between the two.

Negatively, he wrote that he felt that the undergraduate instructor had too much control over the project in general and that this undermined his authority. He did not have the input he would have desired into the design, for the way in which the rest of the undergraduate class was broken up into design teams after the "agency" was selected, and for selection of the agency itself (this decision was shared with the two instructors).

Threaded discussions, in which the students exchanged news and support about their projects, played an important role in the online graduate class. The communication between the participants was one of the class' most successful elements in the estimation of both the instructor and the students. In the threaded discussion, one of his fellow students wrote in response to his report of his experience: "Earlier in the class we had a discussion regarding the democratic approach to projects. Sometimes I think a democratic approach can lose focus. I think your problem is you had too many chiefs and your authority as a project manager was not well defined at the beginning. Thank you for sharing that with us because I think that is a very important lesson." Then she went on to ask him if there is anything he could have done to avoid the problem.

Conclusions

The researchers conclude that it is important to design future class collaborations to be more representative of reality, thereby avoiding role ambiguity. The project manager from the graduate online class was confused by the role of the undergraduate instructor and departmental chairman who simultaneously played the role of client and head of the production agency. Designing the simulation so that the undergraduate instructor's role was clear cut would have helped the project manager, according to his evaluation, to feel more comfortable in exercising his authority. Thus lessons were learned in regard to the need for clarity in the development of simulations and the role of authenticity in the development of a community of practice.

The need to allot enough time for production was another lesson. In the future, the authors will allow for more time in the production schedule as they plan.

Regular effective communication is critical for all instructional project management, and its lack in this collaboration is something that all of the participants noted. In a face-to-face situation, communication is easier to accomplish. Special affordances, such as regularly scheduled meetings by phone or teleconference, need to be put into place to facilitate communication between remotely located members of work teams. Such meetings enhance the ability to negotiate and make decisions and are necessary for team member accountability and for the project manager to exercise the necessary authority. Designing such communication opportunities as routine meetings via phone or teleconference into the structure of the collaboration would have helped the process immensely.

The authors note that while communication between the two classes was flawed, communication within the classes was open and abundant. Routine structures were designed into the online class to facilitate communication between remotely located people. Thus even difficult project management experiences became object lessons as the class shared them via threaded discussion. The authors conclude that role-play simulations can function very successfully in teaching instructional project management, whether or not they are successful as projects.

Implications for Future Collaboration Efforts

There are several implications that can be drawn from this study. First, it is possible for collaboration to occur between an online class and a traditional classroom, by making use of computer-mediated communication. However, email may provide limited structure for such communications. Currently, we are engaged in another collaborative effort to use an online course to provide a collaborative environment for interaction between undergraduates and graduate students. This project is using a third BlackBoard area to provide collaborative space for undergraduates in a traditional class to interact with graduate students in an online course.

Second, a hybrid project management simulation can be a useful tool for preparing undergraduates for:

1) working in developing teams,
2) learning how to interact and negotiate with clients,
3) understanding how to write a proposal in response to an RFP,
4) develop a presentation that may be delivered at a distance,
5) how to communicate within project teams, and
6) how to communicate with clients using various forms of communication.

While using an in-class simulation to teach instructional project management is not unique, the hybrid use of graduate student in an online course with undergraduate in a traditional course presented some unique opportunities and challenges. As more instructional technology departments begin to offer undergraduate degrees in instructional design and technology, such a model demonstrates a way that undergraduates and graduate students can be brought together in a community of practice. The ITT Department at WIU will continue efforts to explore this hybrid model to offer cognitive apprenticeship and mentoring opportunities for our students.

Finally, not all the results were entirely positive from this study and valuable lessons were learned. It is best not to mix metaphors in simulations. The graduate and undergraduate students felt some confusion because of the mixing of client and mentor role for the graduate student. Also, communications between the two groups may need to be very structured at first. Although, undergraduates and the graduate student were frequently encouraged to communicate with each other, both groups complained that there was not enough communication from the other group.

This simulation is being repeated in the near future with the same classes, but with some changes:

1) The graduate student will be in a project manager role, not a client role. This will allow graduate students to mentor undergraduates without having to “step out of character” for a client. It will also allow for more direct involvement in the project on the part of the graduate mentors without having to worry about stepping out of the character of the client.
2) A fictitious client will be used for negotiation and feedback purposes only. Mentoring will be through the instructors and the graduate students.
3) Communications will be strongly encouraged within the class members and across the classes. While videoconferencing will be used, most communications will be through a collaborative online course as vehicle for shared communication. Also, more frequent synchronous meetings will be scheduled
4) The timeline for the project will be started earlier.

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Designing a Full-Service CMC Tool for Incremental Language Skill Development: Electronic Language Acquisition Bridge (ELAB)

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Abstract

Opportunities for non-native English speakers to learn English in naturalistic settings are scarce. Computer-mediated communication (CMC) tools have shown some promise in this regard, but existing online language acquisition tools provide learners with little opportunity to converse verbally with native speakers in natural contexts. The Electronic Language Acquisition Bridge (ELAB) model described here portrays an as-yet undeveloped language instruction system that supports incremental skill development within a single CMC environment. The implications of this approach extend beyond English as a second language (ESL) or English as a foreign language (EFL) instruction.

Introduction

Opportunities for non-native English speakers to comfortably learn English in naturalistic settings are scarce. Consequently, computer-mediated communication (CMC) has shown much promise in creating learning environments that are more egalitarian and less threatening than face-to-face exchanges with native English speakers (Chun, 1998; Warschauer 1997). Furthermore, CMC offers the ability to design more structured and purposeful learning activities that the transient nature of face-to-face communication does not readily allow. CMC technology allows participants to capture their textual and verbal communication, enabling subsequent revision by oneself, peers and instructors. The ability to append feedback and annotations directly to learner dialogue makes feedback especially instructive and helpful.

The goal of our project was to design a system addressing the continuum of technology-facilitated communication intended to generate incremental skill development in ESL/EFL. In addition, we attempted to create an environment for ESL/EFL learners to develop their language skills in the context of generating authentic text and voice-based exchanges. Collateral benefits included 1) opportunity for increased volume of communication; 2) practice not limited by class time and location (time & space). Consequently, we named our design **ELAB**- an acronym for Electronic Language Acquisition Bridge.

Literature Review

The rapid growth of information and communication technologies in recent years is associated with a correspondent increasing interest in computer-mediated communication. Since the late 1980s, the trend has been to integrate the possibilities and complexities for language teaching and learning.

CMC is an umbrella term which refers to human communication via computers- transmit, store, and receive information by the users (Simpson, 2002). The structural format of CMC can be synchronous CMC, where interaction takes place in real time, and asynchronous CMC, where participants are not necessarily online simultaneously. Synchronous CMC includes various types of text-based online chat, computer, audio, and video conferencing. Asynchronous CMC includes email, discussion forums, and mailing lists. In our ELAB design, it's a continuum of moving from asynchronous mode of CMC to synchronous one.

CMC is a possible cognitive amplifier that can encourage both reflection and interaction because speech and writing have merged into a single medium. This kind of text-based communication has the advantages of: 1) allowing students to practice rapid interaction; 2) allowing students to have control for their space in the midst of interaction; 3) encouraging students to be more expressive in this mode than they are in the written mode alone; 4) stimulating creative thinking because of more preparation time allows (Warschauer 1997). In general, synchronous communication seems to encourage communicative fluency. Students' output in the asynchronous communication was lengthy and more syntactically complex than that available in synchronous discussions. Students who communicate synchronously seemed to focus on meaning and disregard accuracy; students who communicate asynchronously had more time to plan their answers and monitor spelling and punctuation (Sotillo, 2000).

Merron (1998) found that students using threaded discussions wrote more thoughtfully than students who were not given such opportunities. Chong (1998) reported the interactive and collaborative nature of asynchronous technology allows students to share perspectives and experiences, and to seek assistance. Further, threaded discussion "allows everyone to be heard" including students who do not normally participate in face-to-face discussions (Kamhi-Stein, 2000).

Many computer-assisted language learning (CALL) studies indicated that network-based communication may be beneficial for enhancing learners' interlanguage even more than oral conversations, as the learner can view their language as they produce it- monitor and edit their message (Warschauer 1997; Kitade 2000). One advantage of using threaded discussion for ESL/EFL learning is the delayed time allowed the learners more time to organize and develop their thought before they "speak out." Kitade (2000) also pointed out that the lack of non-verbal cues [in non face-to-face and non-video environments] may facilitate negotiation of meaning as communicants must rely on verbal correspondence alone. However, the ultimate goal of CALL should be creating an environment that simulates the authenticity of face-to-face communication. Thus it was felt that a need exists to modify current text-based threaded discussions in order to provide ESL/EFL learners increased opportunities to improve both their written and spoken English skills.

"Second language acquisition (SLA) theories advocate that oral interaction that requires negotiation of meaning is necessary for enhancing learners' interlanguage" (Toyoda & Harrison 2002). The Interaction Hypothesis claims that resolving miscommunication (negotiation) enhances L2 learning, as it provides more opportunities for comprehensible input and modified output. The Output Hypothesis explains that producing output is one way of testing a hypothesis about comprehensibility or linguistic well-formedness and that learners' hypothesis testing often invokes interaction between the learners and their interlocutor(s). Native speakers' difficulties in following learners' interlanguage may trigger feedback, which in return may induce changes in the learners' output. Negotiation of meaning also occurs on occasions where the native speakers' input is above the learner's threshold level of understanding (Toyoda & Harrison 2002).

"Whole language philosophy incorporates constructivism theory and proposes that, by experiencing whole written or oral discourse in meaningful units, students learn to analyze the parts and construct new knowledge by reordering or synthesizing relationships between the parts. Language acquisition is, therefore, an active process in which the students focus on cues and meaning and makes intelligent guesses (Steep-Creany, 2002)."

Research by Mayer and Moreno (1998) has indicated that in certain contexts, audio is more effective than text as a means of conveying information. They argue that this is due to the dual processing theory of cognition-working memory has two channels for processing information, an auditory and a visual one.

Our hypothesis is that when ESL/EFL students are presented with both modes (text and audio), their mastery of content as well as their communicative skills in English will be better than when they receive only one mode in isolation (traditional text-only threaded discussion). Based on our review of previous studies, we suggest that CMC-based language acquisition tools should emphasize the development of both speaking and listening comprehension skills in spoken English. A design for such a tool will be discussed in this paper.

ELAB- Design Description

Our design proposition was based on the concept of building an electronic bridge that will enable EFL/ESL learners to become active and effective participants in exchanges with English native speakers through incremental skills development. Learners progress from asynchronous threaded text discussion to simple asynchronous threaded voice exchanges to full, synchronous voice-enabled conversation. We hoped learners would benefit from gaining more opportunities for increased volume of communication and practice with no limit in time and space.

Figure 1.

Progressive Threaded Discussion Model

Text Communication	Audio recording (record +sound attached file)	Audio Communication	Cell phone Audio (speech recognition) Video

-------*From VERBAL Communication to more NON-VERBAL Communication*------
(pronunciation, stress, intonation, facial expression, gestures, etc).

asynchronous **synchronous**

past *present* *future*

FROM Reading & Writing TO Listening & Speaking
------*Gradually integrated the mastery of four language skills*-------

About LEARNERS

Learners get more response time to react in this synchronous communication in both reading and writing	build their confidence through practice & interest through audio feedback	more comfortable in conversing with the native speaker

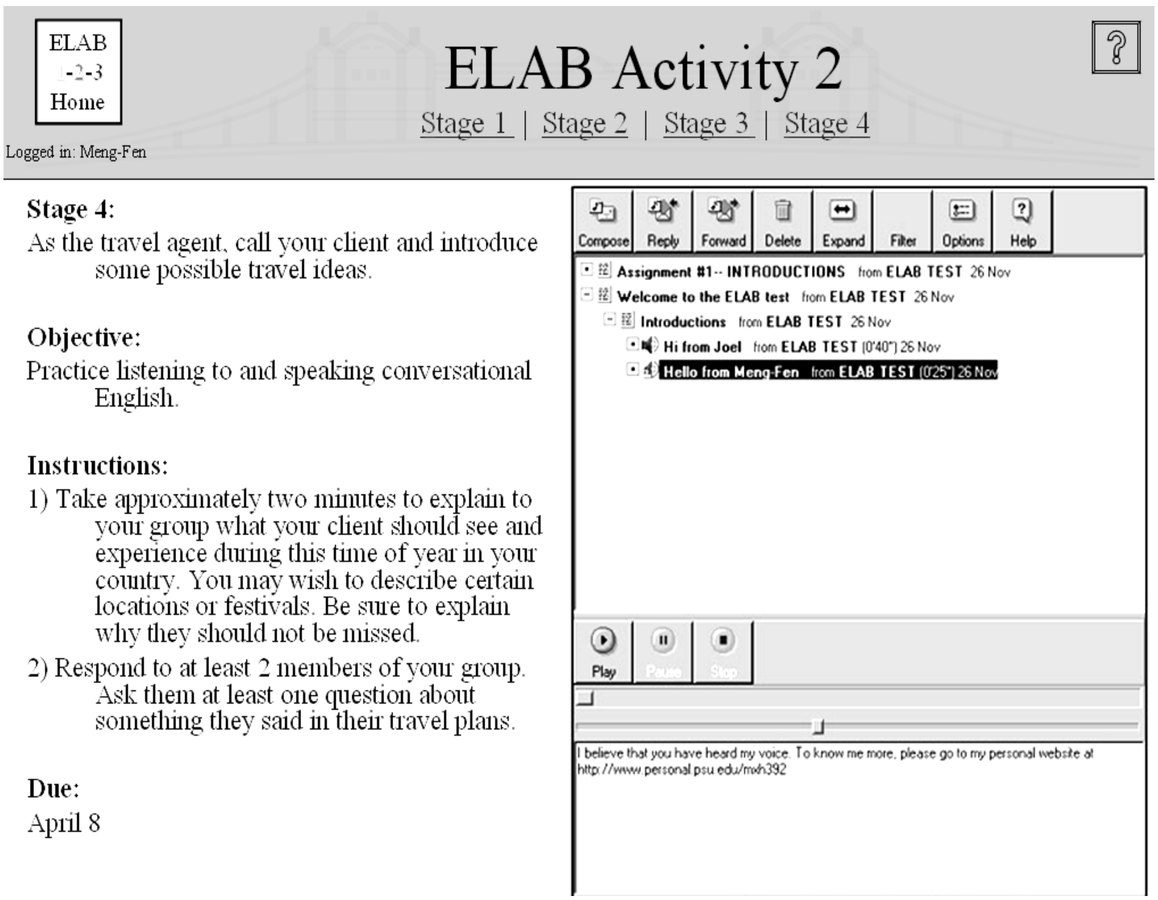
About MEASUREMENT (peer evaluation & reflection)
How often do learners contribute?
How long do they speak?

Phase I: Asynchronous Text Communication

Groups are formed of approximately 4 students, divided evenly between native and non-native English speakers with the addition of native-English speaking moderator. The moderator will provide frequent feedback in the form of reflective questions. Instructors may wish to have native English speakers respond verbally (w/audio) to non-native English speaker's textual comments as an additional listening comprehension practice for EFL/ESL students.

Phase II: Asynchronous, Delayed Audio Conversation

Each student will record a verbal (audio) response for their peer as a feedback. The technology used here will also enable users to compare their audio file with their partner's to compare such qualities as use of expression and comprehensiveness of the recorded message. It is noteworthy that communication in Phases I and II is asynchronous. Students will record comments, replay them, and can choose to rerecord any number of times before posting them.



Phase III: Synchronous, "Live" Audio Conversation

As non-native English speakers become more comfortable with their performance on the threaded audio exchanges, they will engage in synchronous voice-based discussions via the web. Video technology was intentionally not designed into ELAB, but could be added assuming minimum technical requirements could be met.

In order to verify our hypothesis for designing ELAB, we conducted some user testing. Both EFL instructors and students participated in the user testing. Both discussed the value of ELAB for large class situations. In such cases, ELAB elicits frequent discussion from all students in smaller groups and makes non-participation difficult. Both teachers and student felt that, depending on the nature of the activity that ELAB would be useful across all EFL competency levels, and could be used effectively in all main subject areas (Reading, Writing, Listening, Speaking, and Grammar).

After review some of the previous studies, the benefits for ELAB we perceived are listed in the following bullets.

- EFL students can engage in incremental skill development.
- EFL students will have the opportunity to receive context-sensitive feedback based on text and speech-based elaboration.
- Cost effectiveness of learning technology (threaded discussions; asynchronous and synchronous voice-based technology all over the Internet)
- Sharing of knowledge & culture and making friends in a meaningful context
- Leverages existing and proven technologies currently available on the market
- All communication is captured for reflection and feedback

We also perceived some potential challenges for designing an integrated system for multi modal online threaded discussions like ELAB (Electronic Language Acquisition Bridge) based on the previous studies and our results of user testing.

Synchronous communication will require sensitivity to time zone differences.

Asynchronous communication activity relies heavily on the user-friendly interface design and well-organized instruction guidelines for learners to follow. Thus the text design (verbal & visual) should be made as clear as possible.

To create an environment that simulates the authenticity of face-to-face communication, yet provides ample opportunity for EFL learners to review and reflect on their contributions and those of their native English speaking peers.

User satisfaction with ELAB is heavily tied to the relevance and quality of learning activities designed by instructors. For the product to be successful, care must be taken to design support structures within ELAB to guide and encourage quality activities.

In an effort to reduce the anxiety that many non-native English speakers experience when communicating with native English speakers, ELAB revolves around incremental skill development as learners advance from text to voice-based elaboration on various topics. As such, EFL learners can build a greater sense of self-efficacy by gradually progressing from threaded discussion to simple voice message recording with peer feedback to synchronous voice-enabled web-based discussion.

Research suggests the need for full spectrum, full service, multi-modal CMC tools. ELAB fits the needs of ESL/EFL teachers and learners and has its theoretical basis in language learning. User-tests showed that ELAB is best utilized where speech (listening and speaking) and conversation were a helpful and important part of the learning goals.

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Simulations: An authentic learning strategy for HPT?

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Abstract

In an effort to provide an authentic learning experience, one that promotes critical thinking and problem-solving, I designed, developed and implemented a Performance Technology extended simulation for the masters and PhD students enrolled in a Performance Technology course. The simulation focused on challenges faced by performance technologists who work as internal consultants in business and industry. This presentation is a discussion of my experiences running an extended Performance Technology simulation, design considerations, the amount of research required to develop an extended simulation, student perceptions about their learning from the experience, and lessons learned. As an organization tool and because of the process it denotes, the paper is structured around the core elements of instructional development: analysis, design, development, implementation, and evaluation (ADDIE) (Gustafson and Branch, 1997).

Analysis

The Performance Context

The information age, globalization and technology have brought changes to the complexity and speed at which we do business. In the complex working environment of the 21st century, professionals need to be able to accomplish complicated tasks (Prusak 1997 in Oblinger and Verville 1998), which require a high level of knowledge and skills. One of the skills necessary for success in today's global and volatile business environment is the ability to solve problems that are both complex and ill-defined. However, Oblinger and Verville (1998) report that the American Council on Education (ACE) found that graduates of higher education "…lack the critical skills: listening, communicating, defining problems, leveraging the skills of others in teams, and functioning effectively in an ambiguous, complex and rapidly changing environment (ACE 1996, p. 8)".

Human performance technology (HPT) is an applied discipline whose goal is to improve human performance in the workplace (Stolovitch & Keeps, 1999). The practice of HPT involves the application of a set of methods and procedures, developing a strategy for solving problems, and for identifying and implementing opportunities related to performance (International Society for Performance Improvement, 2003). Stolovitch and Keeps state that human performance technologists "…adopt a systems view of performance gaps, systematically analyze both gaps and systems and design cost-effective and cost efficient interventions that are based on analysis of data scientific knowledge and documented precedents…" (p. 10). Based on the definitions of HPT and the professionals who practice HPT it is easy to see how training for this field requires the same skills that Oblinger and Verville state are needed in higher education.

The Learner

Institutes of higher education are experiencing a large in-flux of what were once known as 'non- traditional students' due to the changes in business environment, which have necessitated that employees continuously improve their skills in order to stay current. In fact, Kasworm (2003) reports that in 2010 it is estimated that 38.2 percent of the collegiate population will be twenty-five years or older (p. 4). Kasworm (2003) defines an adult as someone who often has "… competing sets of adult roles reflecting work, family, community, and college student commitments (p. 3)". This description of an adult learner in higher education matches the characteristics of the students in the graduate courses I teach.

Learning Context

As an instructor in higher education and as an instructional designer, I often struggle with providing my adult graduate students with authentic projects that provide them both opportunities to develop their critical thinking and problem-solving abilities as well as provide adequate assessment of their conceptual and procedural knowledge. Many instructional strategies for the promotion of complex thinking skills involve learning activities that take place in actual work environments. However, the compressed time period of a semester, the characteristics of these adult learners in the graduate program in which I teach, as well as the risks of "practicing" in a real situation where the consequences are not foreseeable compelled me to look for an alternative to "real" projects for my graduate Performance Systems Technology course.

The literature suggests that the use of case studies and simulations provide an authentic context that can promote critical thinking and help the learner "…approach problem situations in the same ways that practicing professionals do" (Stepich, Ertmer, and Lane 2001, p. 53). In fact, case studies and simulations have been used extensively in higher education (e.g. Sanci, Day, Coffey, Patton & Bowes, 2002; Jennings, 2002; Hemmes, Long, & Rowland, 1998; Stepich, et al., 2001; Stephen, Parente, & Brown, 2002) as well as in training in business (Linema & Makkonen, 2003; Aldrich, 2004) and military (Noble, 2002) environments for presenting real world situations that, due their nature are ill-defined and complex, require critical thinking in developing holist or systemic solutions.

Simulations are experiential learning strategies that are used "... to help individuals or teams develop problem solving and decision making skills" (Van Tiem, Moseley & Dessinger, 2001, 60). Simulations as an instructional strategy in higher education are designed to help students acquire "...broad discipline-specific knowledge that they are able to later transfer into a professional setting " (Hertel & Millis, 2001, p. 1). In addition the participatory and experiential nature of simulations are thought to improve learner motivation (Faria, 2001) and deep learning (Hemmes, et al., 1998). In addition, simulations provide a safe environment for learning, one that controls the variables so that the learner develops a deeper level of competence before participating in an actual performance environment (Treadwell & Grobler, 2001- p 477).

Although I had utilized case studies in several of my classes, I had never used simulations as an instructional strategy. However, based on my initial learner, performance context, and learning context analysis, I determined that an extended (Hertel & Millis, 2001) simulation was a strong instructional strategy. My learners were nontraditional learners, i.e. they are older, work full time, and have children, and therefore would be hard pressed to conduct a full-fledged performance analysis in an actual work setting. It had been my experience, as both a learner and an instructor, that there were many drawbacks to requiring learners to apply new concepts in an actual setting and in "real time". The performance context, any company that requires a performance analysis, would require the flexibility of knowing how to apply knowledge and skills to ill-defined problems. Therefore the learning outcomes from an extended simulation would transfer well to the performance environment.

Designing the Simulation

Simulations, an experiential exercise appropriate for developing problem-solving skills (Gredler, 1996), are by definition and design a constructivist learning strategy. Dick (1991) in his review of constructivist learning strategies, as they relate to instructional design, raised a concern about placing students in a complex situation for which "Some students probably are capable of dealing with this level of complexity, but certainly some must be overwhelmed" (p.42). While my learner population consisted of adults, they were novices in the area of performance technology. Therefore I used a combination of instructional strategies- case studies, HPT model-building, design of interventions- early in the course in an effort to provide the necessary conceptual basis (entry level skills) for the simulation.

Snow, Gehlen and Green (2002) compared two approaches to introducing a simulation in a graduate business course, a stand-alone approach and an integrated approach. While the factors of confidence and usefulness were found to be the most valuable in judging the success of the simulation, the authors also found that the way a simulation is introduced to the participants plays a role in their learning outcomes. The authors found that an integrated approach increased:

- The learners' confidence in their ability to play the game
- The importance they placed in trying, and
- The effort they reported making (p. 531)

Similar to many instructional strategies, educational simulations are designed around certain learning objectives (Hertel & Mills, 2002) or outcomes. However, experiential simulations are also a "…scenario of a complex task or problem that unfolds in part in response to learner actions" (Gredler, 1996, p. 523). Therefore, while the objectives, choice of business, and general simulation information were developed into an outline before the course began, the simulation actually emerged as the class progressed. It wasn't until I saw what problems the students were having with the material, how the concepts were coming together, and through extensive research into current business trends that I was able to completely develop all of the simulation arifacts.

While both games and simulations have common characteristics, e.g. student control of action, Gredler (1996) states that games and simulations differ in three important ways. The first difference is that games are competitive, and therefore the purpose is to win, whereas the purpose of a simulation is to have students experience the consequences of the decisions they've made while in their roles. Secondly, the event sequencing of a game is usually linear and a simulation the sequence is determined by the decisions the participants make at each decision point. Finally, the consequences of an action taken by a student are determined by rules in a game situation, whereas in a simulation the consequence is a "dynamic set of relationships among several variables that (1) change over time and (2) reflect authentic causal process…" (p. 523).

Much of the research literature on the use of simulations is primarily found in medicine, English as a second language (ESL), computer simulations or secondary school literature. While informative, this literature base was neither prescriptive nor broad-based enough to infer design principles for graduate students in the specific area of performance technology. Therefore, the design choices of the course were most influenced by Hertel & Millis' (2002) book *Using simulations to promote learning in higher education*. Their experiences, while based on simulations in the field of law, within the context of a higher education classroom and the use of extended simulations fit the goals for an authentic learning experience that promotes active participation, problem-solving, and deep learning.

In fact, in his analysis of research that had been presented at Associative for Business Simulation and Experimental Learning (ABSEL) conferences over the past 25 years Faria (2001) found that:

- students have more positive attitudes toward learning from business games (*simulations*) than from other teaching approaches
- greater instructor involvement improved student performance
- more cohesive teams performed better than less cohesive teams
- a positive attitude and commitment to the simulation improved performance
- teams in high simulation/game grade–weighted sections outperformed teams in lower grade–weighted sections

My research on the challenges companies are currently facing involved reading current research, popular books, and surfing the Internet. For example, in her book *The Company of the Future,* Cairncross (2002) discusses the past, current and future uses of the Internet in business. She states that there are five aspects of Internet technology that make it a powerful tool for change (p. 4). She states that these aspects have brought about quicker adoption of the technology, increased globalization and innovation, fostered new decision-making processes, and sped up the innovation process. Really want to stress the similarities between the management issues she addresses and those addressed in HPT. These ideas fit well with the International Society for Performance Improvement's (ISPI, 2003) definition of human performance technology, the processes it follows, and the intended outcomes of the process.

Cairncross' (2002) ideas related to the company of the future, specifically her emphasis on the future of Internet for business practices, not only provided a framework for the "what should be" for current practices for the company portrayed in the simulation, it also provided the impetus for choosing a company that was already using the Internet for some of it's communications.

Development & Implementation of Simulation

As stated earlier, the design and develop of materials for the simulation evolved throughout the simulation experience in response to student needs and perceived learning opportunities. This simulation was not an individual effort but rather a team process. Most complex problems, such as performance technology problems, require the input of several perspectives. In fact, collaborative team-building skills are expected and utilized extensively in business and industry.

Although there were two teams, the design was an experiential simulation (Gredler, 1996) rather than a game. Each team worked independently, received the same information, the same opportunities for data collection, and was graded on the same rubric. The only difference was the choices they made on what data to collect based on the questions they asked in the interviews. The answers to those questions, which were loosely scripted, influenced the teams' decision-making process and their choices about which information to pursue. For example, in the debriefing the two groups had very different experiences in their interviews with two of the players.

> Member of Group 2: It's very interesting because for our interviews, I felt like the *VP of Marketing* and the *VP of Research and Development* switched roles. The *VP of Marketing* was much more difficult to get information from... sharing information *VP of Research and Development* was, now, here's what's interesting, that one of your *(referring to Group 1)* major suggestions or interventions was relevant to research and development and ours was not; we felt like everything was on track, I mean isn't that kind of interesting?

The perceived performance problem for Fort Dodge Animal Health, a subsidiary of Wyeth Pharmaceuticals, was stated as a failure to meet sales expectations. This information was provided to the two "inside performance technology teams" during an interview with the "VP of Human Resources" of Fort Dodge (the instructor). During the same interview the teams were provided with a schedule of the stakeholders they would interview. The stakeholders consisted of upper and middle management. As the simulation evolved, and at the request of the teams, an interview with customer service representative was subsequently scheduled. There were a total of six interviews for each team. Then, from the stakeholder interviews, and other data collection activities outside of class (e.g. benchmarking) the teams developed their needs assessment and the processes for performance gap resolution.

Simulation Experience from a Student Perspective

The integrated strategies that we completed in the first half of the semester aided our recall prior knowledge as it relates to HPT and afforded us an overview of the steps necessary to perform a thorough performance analysis, thereby providing us with a well-rounded understanding of the challenges we would face during the simulation. These early exercises provided a basis for consideration of how to best develop appropriate questions that would facilitate data gathering process throughout our interviews.

The simulation experience was quite realistic. The instructor used a real company and devised a authentic problem that challenged us to consider various conclusions and how we would implement them. Then, based on our initial hypothesis we gathered data through interviews with several "actors". In addition, the benefit of using a real company allowed us to use the Internet to research similar companies and compare their practices to those of Fort Dodge for benchmarking purposes. Both of these practices increased the fidelity of the simulation by providing an interactive experience by exploring multiple perspectives and practices.

Group processes that involve reflection and higher order cognitive considerations have proven to be instrumental throughout my work as a graduate student. By having the opportunity to share and scrutinize my ideas and share various perspectives with a group of students, I feel not only that my current learning experiences been enhanced but that I have also been stimulated to develop a philosophy of learning and a direction for future research. In addition team experiences have taught me to evaluate and form arguments about other viewpoints based on my prior leaning experience.

Initially, we reviewed the data from the interviews we had conducted and developed our own conclusions before meeting. Next we met to discuss our conclusions and collaborate to reach consensus on what our next steps should be. This was a scaffolding process by which we built upon each phase of data gathering.

Once all the interviews were complete we then took a step back to piece together our perspective of the performance gap and begin to establish a rationale for possible solutions. In addition, we used the Internet to research similar companies that we would use as benchmarks for a comparison of the Fort Dodge operations. We focused on Pfizer pharmaceutical because they have an animal health division, were number one in the nation for sales in the animal health market, and appeared to exemplify "best practice". Through reading Pfizer's practices and comparing them with what we had learned from our data collection on Fort Dodge we clarified the goals applicable to our performance analysis.

The opportunity to explore, without the pressure of making mistakes, provided us with the latitude necessary to investigate the performance gap thoroughly and make recommendations without fear of negative consequences. In a real world environment there would be obstacles I would have to face as an adult graduate student, i.e. the availability of time, coordination of people and data gathering. These obstacles would have limited my ability to accumulate data for a successful learning outcome.

For me, the data gathering and analysis process was the most beneficial aspect of the simulation; the opportunity to analyze information, and propose a solution was an excellent exercise in the application of fundamental of HPT. Give and take within our group was excellent and provided a forum for dialog, theorizing and solution proposals.

As for any dislikes or changes I would made; I would have liked to see the simulation develop an Intranet as a repository of information for both the students and the actors to assure consistency and uniform availability of information.

Did the simulation fit my needs as a learner? Yes, I found myself immersed in the experience, it opened a path to analyze circumstances and think about solutions. I was able to explore a multitude of variables affecting performance and thereby better understand the phenomenon of a performance gap analysis. I was able to appreciate the process of designing a model for a particular performance need and then formulate an implementation program for resolution of the performance solution.

Formative Evaluation

The formative evaluation process included both group and individual feedback. The first part, a group debriefing session, was conducted after the simulation was completed and each group had presented their findings and recommendations for Fort Dodge Animal Health. Assessment for constructivist learning experiences is challenging. While the focus for a constructivist-learning environment is on facilitating the learner's construction of knowledge, the intent for the instructional designer (instructor) is to determine what has been constructed (Dick, 1991). Debriefing, a process for helping the learner to connect their experiences in the simulation to their past experiences, the learning objectives of the simulation, and future practice (Lederman, 1992), serves as an assessment tool for experiential learning activities (Hertel & Millis, 2002).

The debriefing was on Hertel and Millis' (2002) questions for conducting an extended simulation briefing. An example of one of the questions asked near the beginning of the debriefing was "Did your level of emotional involvement change during the simulation?" One student's response was that "… as we talked to the interviewees and gather more information, I think it changed a little bit because you became more aware of what was going on in the company and … what was at stake." The follow up question to the same student was "Would you say that you became more involved?" The student's response was "More involved, absolutely, as you became more familiar with the situation."

Immediately after the debriefing, each student completed an individual questionnaire about the course, which included questions related to the entire course and specifically to the simulation. One of the questions asked the students to complete the statement "What I liked best about the course was____ because_____" The majority of the students (4/5) stated that the simulation was the best part of the course. The reasons were because it was "realistic", "a realistic application of skill", and "application is the only way to understand effective intervention techniques". The students were also asked to rank the three most relevant assignments in the class. Table 1, below, shows the results from that question:

Table 1 *Students' rankings of course activities*

Rank (1=highest)	Number of respondents	Activity
1	5/5	Simulation
2	2/5	Simulation report (PT Analysis Report)
2	1/5	Intervention Assignments
2	1/5	Case studies
3	2	Case studies
3	1	Individual project
3	1	Intervention Assignments
3	1	No answer

Finally, when asked how effective the simulation was for their learning the students gave a 5 pt rating (on a 1-5 rating scale, with 5 as the highest) across the board.

Student Evaluation

I think the preparatory work that the instructor did was well thought out and enabled us to become quickly immersed in the simulation and learn as much as possible about a HPT environment without the risk of a real world application. The tools we were provided with were minimal, yet sufficient enough to facilitate a productive learning environment through the simulation. The opportunity to experiment in a learning environment that provides the tools for a successful performance evaluation, such as interviews, benchmarking and general information about the company we were to analyze, greatly enhanced my learning experience and the retention of material that I learned through the exercise.

Lessons Learned

While I thought this section would be a warning for all extended simulation designers to be as prepared as possible before staring the simulation, the fact is that is not entirely possible or even desirable. I found that because I had some flexibility during the simulation I was able to respond to the simulation participants' (both students and actors) requests. However, the flip side to this lesson is that one must also be prepared for unforeseen contingencies and have a back-up plan.

Some of the most important observations were that the students were very motivated, very involved the simulation, and processed information at a deep level. I believe it was the level of fidelity of the project and the amount of control they were afforded that helped the learners to use their newfound knowledge of PT to develop higher levels of problem-solving and critical thinking. At the same time, the structure of a planned simulation was important in providing a safe learning space while still at a novice level of performance. Because these observations are anecdotal, I will conduct a study this spring to gather empirical data to investigate the types of learning outcomes- both cognitive and motivational that are promoted through the simulation experience.

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Student Teachers And Filmmaking: Representing Understandings Through Multiple Literacies

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Abstract

This paper reports on the creation of meaningful learning environments on campus in which student teachers employ digital filmmaking techniques to amplify their learning, represent their understandings and communicate in new ways. Constructivist learning conditions were created whereby novice teachers learned in the same ways they must teach today's media savvy children. Ill structured problems provided the context for designing diverse solutions using technology. The social construction of knowledge was emphasized as student teachers worked collaboratively to design and produce their ideas using film. Diversity was not only valued but became essential for completing filmmaking tasks and helping novice teachers to begin to break the "teaching the way we were taught" cycle.

Student teachers: Once we completed the project we began to realize that the project wasn't really about technology at all; technology was simply the means to an end.

Introduction

As we shift from an industrial to a knowledge-based economy, there are major implications for how children learn in schools and how new teachers must be prepared on campus. Beginning teachers enter classrooms populated by tech-savvy students who interact skillfully and fluently with technology and information in ways that are different from those of the teacher's generation. These third generation students (Norton & Wiburg, 1998) use and interpret technology in very different ways. Student teachers need to experience the same type of inquiry-based, technology-rich learning experiences on campus that they will be expected to create for children in their classrooms (Jacobsen, Clifford & Friesen, 2002; Jacobsen & Goldman, 2001). Workshops on how to operate the computer fail to provide sufficient time or opportunity for teachers to reflect on their beliefs and practices and to explore how technology can be woven into a meaningful learning environment (Sprague, Kopfman & de Levante Dorsey, 1998). Student teachers need intentional mentoring and support in the use of technology-enhanced, inquiry-based learning methods on campus and in their field experiences in order to resist the urge to "teach the way they were taught" as they encounter the many daily stressors and ill structured problems that characterize teaching as they begin their professional careers.

A key challenge for faculties of education is to graduate new teachers who can embrace pedagogical and technological change and respond fluidly when presented with multidimensional, ill-structured problems (Jonassen, 1997). In this paper, we report on the creation of meaningful learning environments on campus in which student teachers employ digital filmmaking techniques to represent their understandings. Filmmaking experiences provide opportunities for student teachers to wrestle with authentic, meaningful and challenging instructional problems from which they can then learn how to design diverse instructional interventions for their own students. We believe that it is through lived experiences designing with technology that novice teachers can begin to adopt changed dispositions toward teaching and learning and begin to integrate innovative approaches to problem solving with technology in their work with children.

Our assertion, that faculties of education must graduate teachers who can respond and be sensitive to the myriad of complex and diverse perspectives and emerging technologies that they will face as they invite increasingly tech-savvy students to learn with them in expanding and distributed learning environments, is well supported by research (Palloff & Pratt, 2001; Willis & Mehlinger, 1996). Our second assertion, based on research and experiences teaching with technology on campus (Jacobsen, et al., 2002, Jacobsen & Lock, 2003) and our experiences supervising student teachers in the field, is that intentional mentoring and support does enable novice teachers to implement technology-enhanced inquiry projects for learning in spite of the many challenges inherent in this pedagogical approach.

An Inquiry-based Teacher Preparation Program

Unlike well-structured textbook problems, the ill-structured, real-world problems of professional practice are not pre-defined but emergent (Jonassen, 1997). In 1996, the Faculty of Education at the University of Calgary dismantled its textbook and course-based approach to teacher preparation in favour of an inquiry-based, field oriented and student centered program. The majority of teacher candidates who are accepted into this Calgary, Alberta program have completed a three or four year bachelor's degree. The Master of Teaching (MT) program at the University of Calgary is a two-year professional teaching program leading to a bachelor of education degree. The MT Program philosophy is based on thinking differently about teaching practice. The MT Program was conceptualized on the understanding that teaching is largely a non-rationalized practice that resists step-by-step methods and solutions. From this view, teaching certainly requires content knowledge and skills; however, it is not simply defined as the application of a predefined set of skills and discrete disciplinary knowledge to achieve curriculum objectives. Student teachers participate in case, field and professional seminars, in which they interrogate curriculum and contexts, learners and learning, teachers and teaching, and explore the ethical, social and political contexts that frame the teaching profession.

Integrating Technology Across the Curriculum

The context for inquiry in this case study is a second year, semester four special topics seminar, entitled "Integrating Technology Across the Curriculum." The two of us team taught this seminar to thirty-five students. No longer do we cycle students through a course on computer applications, as is the perceived need and design in many conventional four-year bachelor of education programs. A technology survey revealed that we were working with a more experienced and technology savvy population of undergraduate students who already have experience using email, word processing and conducting research using the Internet (Jacobsen & Clark, 1999, 2000). Instead, learning with technology is incorporated into field, case and professional seminars and is offered as an elective during the final semester. In Winter 2002 and 2003 we immersed student teachers in a culture of inquiry focused on technology integration across the curriculum (Jacobsen, et al., 2002). We created constructivist learning conditions whereby novice teachers learned in exactly the ways they must teach today's media savvy children. The five interdependent attributes of meaningful learning, described by Jonassen, Peck, and Wilson (1999) as intentional, active, constructive, authentic and cooperative, characterized the learning environment we felt was critical for student teacher learning and professional awareness.

The social construction of knowledge was emphasized; student teachers worked collaboratively in groups to complete focused technology tasks designed for school children, and then built upon this understanding to develop rich, instructional plans for teaching. A theoretical framework and rationale for required group work is provided by Vygotsky (1986), who argued "… the true direction of the development of thinking is not from the individual to the social, but from the social to the individual" (p. 36). Filmmaking requires students to draw upon a diverse range of talents and skills. "What the child can do in cooperation today he can do alone tomorrow. Therefore the only good kind of instruction is that which marches ahead of development and leads it" (Vygotsky, 1986, p. 188). We deliberately required student teachers to work together on complex problems that are difficult for one person to solve to promote the idea of professional practice being an ongoing conversation that occurs in a community of inquiry.

Filmmaking tasks were designed to be meaningful, challenging and authentic. Tasks were inclusive; no matter what the technological starting point, all students had a role and made a contribution to the final outcome. We structured the task to give both clear guidance and flexibility in order to honor student ownership in the execution of the final product. Students were cast as members of a film team whose current assignment was to create a new 3-minute video of a well known story (i.e., legend, myth, or fairy tale) that could be shared on the internet. Students assigned each other roles, made decisions, booked equipment and human resources, identified and solved problems, and sought out additional skills and expertise when needed. Assessment rubrics were designed such that students were evaluated using a range of multi-disciplinary outcomes. A premium was placed on the clarity and elegance of student products. Recognizing that the work is never quite finished is at the heart of a meaningful inquiry project. We observed high student engagement and investment in the filmmaking tasks. Student teachers cared deeply about the quality of their work because it would be celebrated publicly with their peers, not just privately with their teachers.

In a reflection on the creation of "Icarasaurus", a film retelling of the ancient myth about Icarus, McKie, Smith, Milner, and Green (2002) describe how their group had a variety of opportunities to create projects and learn about technology through constructivism. The four member team drew upon the group's diverse strengths, from acting to technology fluency to set design to planning, in order to achieve their goal of a three minute movie published online. They researched and compared two published versions of the Icarus myth, created storyboards of these existing stories, wrote their unique version of the myth, created a production storyboard and shot lists, designed an elaborate set and cast a main character (i.e., plastic dinosaur), and began shooting raw video. The group published photo evidence of their filming and editing process online with the final video version of their story. The following is an excerpt from an online reflection about the learning process (McKie, Smith, Milner, and Green, 2002).

> This was an invaluable experience because we were able to design units and activities that we could use in our own classrooms (in the near future), as well as experiencing what it is like for students to create and learn with the infusion of technology. We were expecting to learn a lot about technology and the process of integrating technology in meaningful ways. What we didn't expect was to have our outlook on teaching and learning change based on what we discovered when technology and constructivism collide.
>
> The first revelation that we had was how much fun this project was. The guidelines put forth in the storytelling (filmmaking) focused task allowed for a lot of choice while working within a set framework that had clearly defined expectations. Choice and freedom within a clear set of guidelines allowed for our creativity to bloom as we were not concerned with unknown expectations.
>
> The entire process was one of creation (from choosing literature to designing sets for the movie) where we were allowed to take the project as far as we wanted to go, and of representation by using the digital media tools we thought would represent our story in the most powerful and meaningful ways. While we were learning about the technology and how to project our vision, each of us also saw the amazing potential for our own classroom with the high level of engagement and links to the curriculum. Filming Icarusaurus together was so much fun because we were exploring what it truly means to learn in a constructivist classroom and we wouldn't have learned half as much without completing the focused task ourselves.
>
> The second realization was that group work could be an enlightening learning experience where we could learn from and teach one another. This project was created in a learning environment where we were expected to learn, plan and problem solve as a team, using skills and technology that were new to many of us. This allowed each of us in our diverse group to showcase our talents and expertise while feeling comfortable enough to take risks in learning and grow tremendously as both learners and future teachers. Project-based learning is often more open-ended and has the potential to appeal to all types of learners so that success and confidence follows in its wake. This was evident within our group where each of the members' interests, background knowledge and learning styles were honored and explored throughout the planning, filming and editing stages. This helped us to see the potential for group-work in our own classrooms where students learn both from and with one another, and diversity is a necessary ingredient for group success.
>
> Finally, we truly began to understand how exciting technology could be when infused with meaningful and challenging learning. Once we completed the project we began to realize that the project wasn't really about technology at all; technology was simply the means to an end. Utilizing technology in telling a story allowed us to be much more than writers and storytellers; it allowed us to be planners, organizers, set designers, puppeteers, camera people, artists, directors, editors and problem solvers- real life skills that will serve us well in future projects. We had to negotiate individual expectations, make complex decisions, use technology to communicate and exchange files, and meet often as a group.
>
> In closing, this project was an amazing first step on the journey that we took in the ICT Special Topics seminar that helped to guide our understanding of the role that technology should be playing in schools and learning today. By becoming students again and experiencing the power of constructivism through meaningful collaborative work with a multi-disciplinary focus, we began to see how learning could be enhanced by integrating technology, rather than by teaching technology for the sake of technology.

The “Icarasaurus” project (McKie, Smith, Milner, and Green, 2002) exemplifies the type of work we encouraged students to engage in and commit to during the seminar. Members of this group transferred the experience and energy created in this project to subsequent, more complex filmmaking projects that they completed with other peers during the seminar. We have had the good fortune to continue our work with two of these beginning teachers, and have observed how they carried the experiences of the focus tasks and integrated units of study into their actual practice with elementary children. We have observed how the beginning teacher’s awareness of instructional planning and differentiated instruction have matured as they confront the challenge of structuring filmmaking tasks that are inclusive of all students’ skills. The beginning teachers initially did not require the pre-planning and storyboarding, and just let the kids loose with the camera. Through experience and by assessing the students’ movie projects, these beginning teachers have learned with the children the importance of stressing process over product

Jonassen’s (1997) model for solving ill-structured problems presents an approach to problem solving that provides an additional context for considering and understanding the intentional design of our focused tasks, including the storytelling and filmmaking task. His model includes various processes as follows: (1) Articulate problem space and contextual constraints; (2) Identify and clarify alternative opinions, positions, and perspectives of stakeholders; (3) Generate possible problem solutions; (4) Assess the viability of alternative solutions by constructing arguments and articulating beliefs; (5) Monitor the problem space and solution options; (6) Implement and monitor the solution; and (7) Adapt the solution (pp. 79-83). Jonassen’s first two steps correspond to problem formulation which is a prerequisite to problem solving. In the filmmaking task, we articulated the problem space and provided contextual constraints (i.e., you are part of a film team charged with the task of retelling an ancient myth in a three minute movie that is published on the web). The students were required to analyze the problem from the perspective of each group member, and generate possible solutions. Students created storyboards of existing myths and legends prior to developing and pitching their own idea for a retelling. Based on peer feedback, the film team created the final production storyboard. Hence, students assessed the viability of alternate solutions by constructing arguments based on experience. Managing the filmmaking project required pre-planning, organization and active problem and project management. Shooting raw video and editing film were both part of implementing plans, altering plans and monitoring the outcome. Peer review required each group to reflect upon the film they created, and to consider ways to refine their work. Knowledge and experiences with technology cannot be given to students. We actively engaged our students in our own thinking and reflection on technology integration as they were doing with technology. We interrupted each other’s presentations to make explicit to the students key points that were made, recognizing that the “obvious” about constructivism isn’t so obvious to the novice (or to many experienced teachers). We realized that we could only share stories from our experience, that we could not hand over our own experiences to our student teachers. Instead, we had to work together in an inquiry culture to build knowledge about technology, teaching and learning together. “Learning from teaching through inquiry assumes that beginning and experienced teachers need to engage in similar intellectual work. Working together in communities, both new and more experienced teachers pose problems, identify discrepancies between theories and practices, challenge common routines, draw on the work of others for generative frameworks, and attempt to make visible much of that which is taken for granted about teaching and learning” (Cochran-Smith & Lytle, 2001). Filmmaking enabled us to entice students to engage in a deeper level in learning about learning with us. Through projects like Icarasaurus, student teachers learned first hand through experience, and deepened this understanding of instructional practice through reflection and dialogue in a community of inquiry.

Practical Experience also shows that direct teaching of concepts is impossible and fruitless. A teacher who tries to do this usually accomplishes nothing but empty verbalization, a parrotlike repetition of words by the child, simulating a knowledge of the corresponding concepts but actually covering up a vacuum (Vygotsky, 1986, p. 150).

We resist the urge to lecture about constructivism and technology, choosing instead to interact meaningfully with our students. Our learning space was a studio rather than an instructor lead classroom modeling our understanding that the arts emphasize the creation of coherent structure, encourage multiple solutions to problems, prize innovation, rely on the use of judgment, and depend on the use of sensibility (Eisner, 1998). Our learning environment supported play, adventure and exploration with technology. We resisted the urge to lead whole class sessions on how to work the camera, or how to publish learning objects on the web. Instead, in response to needs that arose from students’ engagement in the projects, we did small group teaching.

Students needed access to our thinking about constructivism, as well as first hand experiences in inquiry-based, technology enhanced learning environments, in order to create similar learning experiences for their own students. We reflected on the learning environment with them, helping them to make sense of their own learning experiences. We described our design so student teachers understood the type of instructional planning and dispositions that allowed this type of inquiry-based learning to happen. We facilitated professional conversations about how to understand and translate first hand experiences into personal models of informed practice.

When student teachers grapple with the task of producing a short film of their ideas they are developing multiple literacies that go well beyond text and graphics. Multiple literacies relate to the ability to construe meaning in dominant media forms used in a culture to create and convey meaning (Eisner, 1998). Because film is prevalent in our culture, learning how to read and create video is critical to informed citizenship in this century. Imagination is central to the process because we cannot know through language alone what we cannot imagine (Eisner, 1998). We designed the filmmaking tasks as ill-structured problems, or open-ended tasks, for which there are many possible "solutions" or responses. Ill-structured problems typically do not have a single "right" solution, but multiple possible solutions. Jonassen (1997) argues that "since ill-structured problems typically do not have a single, best solution, a learner's representation of it should assume the form of an argument… The 'best solution' is the one that is most viable, that is, most defensible, the one for which the learner can provide the most cogent argument" (p. 81). Filmmaking provide an opportunity for students to grapple with ill-structured, open ended problems, amplify their learning, represent their new understandings and communicate in ways that they have only been passive consumers. Students become critical consumers of the messages and media images created by others and develop as connoisseurs and active creators of their culture through the design and production of their own messages.

The Compelling Nature Of Film

The decision to offer our student teachers an opportunity to engage in filmmaking was intentional. We had experienced the excitement and value of engaging high school students in filmmaking using Apple Computer's iMovie software. We knew from extensive work with children and technology that authentic learning experiences that allow students to develop meaningful products that can be shared with an audience beyond the teacher (Cohen & Riel, 1989) not only capture students' imaginations but can also change students' lives. For example, our work with at risk youth helped us to understand the power of visual media to entice these students back into formal learning and empower them to tell their important stories in non-text ways. Designing and producing ideas using digital media liberates all students from conventional school structures that tend to still privilege reading, writing and mathematics.

From our experiences with emancipated learners, we knew that filmmaking would draw on a broad skill set as it requires "… a collaborative process that brings together talent and energy of many artists from a variety of … backgrounds" (Theodosakis, 2001, p. 92) to complete a project. The need for collaboration becomes obvious to students as they take on filmmaking rather than having to be imposed by the teacher. Filmmaking requires students to articulate individual talents and interests and then pool their diverse skills in order to make good choices as group members. Roles are not arbitrary. While one member might be able to envision the project and pitch it well, another member may have the graphic skills required for set design, etc. None of the tasks are hypothetical or contrived as all are essential for the completion of the final product. While one may initially think only of the roles of editor, set designer and cameraperson, Theodosaskis (2001) suggests five distinct roles in each of the five phases of film development. These roles should support a range of learning styles, assuming the task has been structured in such a way to encourage and value collaboration.

Engaging students in learning activities such as filmmaking allows them to begin to understand the "… processes that experts use to handle complex tasks," (Collins, Brown, and Newman, 1989, p. 457) and to join that community of expertise by attempting to solve ill-structured problems as the expert might. Lave and Wenger (1991) extend that sense of expert practice, suggesting that a novice's "… ability to understand the master's performance depends on engaging in the performance in congruent ways, suggesting "… if learning is about increased access to performance, then the way to maximize learning is to perform, not to talk about it" (p. 21). The distinct roles, identified by Theodosakis (2001), and supported by pre-filming activities, such as brainstorming and storyboarding, help students to understand the complex nature of professional filmmaking and to become more critical consumers of the medium.

Further, it has been our experience that filmmaking is both an invitation to join the community of filmmakers and a guide for the engagement in authentic tasks that constitute the process of making movies. Filmmaking has the potential to support the social construction of knowledge stressed in the literature (Vygotsky, 1978; Bereiter & Scardamalia, 1993) because it requires the diverse skills suggested above and it encourages meaningful group work and authentic collaboration.

We view film as "… a powerful tool for sharing, understanding, educating, documenting, indoctrinating, and entertaining" (Crichton, in Press) and we recognize that "Until recently, film has been a passive experience for the majority of us. We went to movies and watched them; few of us considered actually making them" (Crichton, in Press). We regard iMovie as an enabling piece of software with high usability. Students of all ages can quickly understand the conceptual design of iMovie and begin editing raw video within an hour or two. However, student authoring using iMovie requires that educators recognize that multimedia projects such as film are as real and important demonstrations of understanding as text can be.

Based on observations of children using Apple Computer's iMovie software to create powerful representations of ideas important to them, we decided to make this experience available to future teachers. iMovie is a powerful desktop filmmaking tool that supports the development of multiple literacies, imagination, creativity and thinking. The usability of this ergonomically elegant videoediting tool enabled us to realize the benefits of filmmaking for student teachers. It is not that other digital filmmaking tools do not exist. They do. However, novice users can understand and use the iMovie interface and firewire data transfer quickly and easily, and then the tool fades into the background as the filmmaking process itself becomes central.

Because of the demands iMovie places on the hardware, it forces an elegance of thought and design. Two to three minute movies become the standard as considerable amounts of hard drive memory are consumed for storage of the data and the editing features (adding sound, titles, transitions, etc.). This shift from quantity to edited quality, encourages the filmmaker distill his/her thoughts and to engage in meaningful inquiry as to what is important in the message, both forcing and encouraging wise editing. Eisner (1998) writes eloquently of the importance of the editing process, explaining "… there is nothing so slippery as a thought. … Working with a form of representation [text, video] provides the opportunity to stabilize what is ephemeral and fleeting. It gives students an opportunity to *hold onto* their thinking" (p. 27). Further he suggests "editing allows one to refine one's thinking, to make it clearer, more powerful, and, not least, to appreciate the happy results of creativity. It allows one to confer a personal signature to a public product" (p. 27). We know that digital editing lets the filmmaker revise, edit, modify the images, allowing her/him to take an idea further and to incorporate other digital media to support the project.

We have observed that filmmaking allows for the power and spirit of play to come forward. The original footage is available, so one can plan and experiment with images, both graphic and auditory, until the desired results are achieved. These images can be shared, collaboratively editing and modified, with the original filmmaker retaining access to the initial footage (Crichton, 2003). This allows one to manipulate the original content extensively, even to the point of throwing the work away as the original footage is safe on the tape in the camera that filmed it, allowing the filmmaker to start all over again with the editing process.

However, we cannot emphasize strongly enough the importance of meaningful instructional tasks that focus on complex, ill-structured problems with multiple possible solutions. Jacobsen, et al (2002), have noted that typically "… task[s] involving technology tend to involve a fairly low level of thinking and research, focusing heavily on the presentation of final products rather than on thinking differently, rigorously and effectively at every stage …" (p. 2). Simply adopting iMovie as a neat new gadget in the classroom tool set will not in itself promote innovative learning. Instead, sound instructional tasks designed to incorporate the process of filmmaking and the type of ill-structured problems encountered by teachers can get beyond those low level skills by encouraging students to engage in the personal construction of meaningful learning and supporting the range of multiple intelligences and learning needs suggested by Gardner (2000).

Filmmaking honors process over product, especially if the tasks that it supports are tied to sound learning outcomes. We note that filmmaking using iMovie supports the "just in time" approach to learning with technology that is consistent with our view of technology integration as it does not require extensive workshops or training. Rather, we have found that students learn the specific skills required to make their films as they engage in the project design itself. However, we did ensure that rich, just in time resources and support were available. We recognize that challenging students to work through problems is one thing, but that we cannot risk frustrating them with either faulty equipment or missing pieces of critical how-to information. Therefore, we knew that books, manuals, support documents, and human resources were available to the students.

Discussion

We believe that in order for more school children to experience learning as knowledge building in technology enabled environments, their teachers need to experience and understand learning in these ways. Student teachers and their experienced colleagues need learning experiences that model the cultural shift from being passive receivers of information to becoming active builders of knowledge. So, based on this reasoning, we offer these three reasons for why student teachers require the type of authentic and meaningful learning experiences that are provided by filmmaking. First, as future professionals, novice teachers need opportunities to analyze and solve ill-structured problems that draw upon their diversity, their creativity and their imagination. Teaching is not a step-by-step, well-structured problem domain, nor is it a solitary endeavor. Second, new teachers will be working with media savvy students who are creating, and can create, in this medium. Beginning teachers need to be media literate and author using multiple media in order to be a scholarly guide to their students. Third, and most important, new teachers can provide leadership and champion innovative practices in the field. We have shared two stories about new teachers who transferred their filmmaking experiences into reformed practice for elementary students. In one case, a student teacher actually carried the computer and digital video camera into the grade one classroom to demonstrate with the children how filmmaking was possible in the very early grades. The partner teacher, who was initially uncertain about whether filmmaking would be accessible to the students, was able to learn from her protégé. In many cases, student teachers cannot simply model and mimic their partner teacher's practices with technology because many experienced teachers are grappling with meaningful integration themselves. Instead, student teachers who have experienced meaningful technology design and development, like those who completed filmmaking and other focused tasks in our seminar, bring value and innovative practice to the table and can make an immediate contribution to changed practice by championing innovation in the classroom.

Filmmaking enabled our students to discover for themselves the importance of diversity – in terms of learners' tasks, skills, and experiences. And this understanding is essential for breaking the "teaching the way we were taught" cycle. In our ongoing work with our second year teachers we have had the privilege to observe how they have made filmmaking their own. They can clearly articulate the importance and power of engaging their students the types of tasks we value. They place premium on creativity and imagination, linking both to authentic demonstrations of knowledge and questioning professionally what is worth knowing and understanding. They have demonstrated to us, and more importantly to their students and colleagues, that movie making is an exciting entry point for technology integration, recognizing that "The starting place is where … [a person is] at the moment …" (Jacobsen, et al, 2002, p. 11) and that the diversity of the starting point is "… not a problem to overcome but a strength to draw on …" (p. 11).

Based on the outcomes of our work with student teachers, and the transfer we have seen to first and second year teaching practice, we believe we have developed a sustainable model for educational reform. One teacher at a time, one classroom at a time, we can make a difference in the rich learning opportunities that are available to children.

It goes on one at a time,
it starts when you care
to act, it starts when you do
it again after they said no,
it starts when you say We
and know who you mean, and each
day you mean one more.

Marge Piercy, "Low Road", cited in Palmer (1998)

We live our work with beginning teachers, one at a time, in authentic mentoring relationships that are cultivated in a culture of inquiry. We see our work as intentionally transforming the learning opportunities available to today's children. We continue to work with graduates who are now teaching and conducting research on integrating technology across the curriculum. We are working with a second year elementary teacher on classroom-based research projects that engage elementary school children in multiple forms of literacy by exploring authoring and media. We have worked with a student teacher who made filmmaking the focus for her final semester inquiry project and felt empowered enough to champion its use in a school that had not used it before. She read Theodasakis' (2001) book, The Director in the Classroom, and borrowed filmmaking equipment to take to the school. She studied the impact of filmmaking on primary students' learning and engagement. As we move forward with this approach to technology integration in teacher preparation, we see each interaction and each project as a possible ripple that will extend outward. Who knows how far it will go.

Future Research

New teachers enter the profession filled with hope and expectation. However, too many new teachers find themselves isolated in classrooms surrounded by colleagues who may not have the necessary time, skills or dispositions to support or encourage new colleagues for continued growth or innovative technology practices. The induction of new teachers into the profession should not be left to chance. While student teachers may experience inquiry-based, technology-enhanced learning on campus, they need ongoing support as new teachers to implement these approaches in the classroom. The next stage of our research is to investigate the nature of onsite and online mentoring and support which enables first and second year teachers to implement inquiry-based, technology rich learning experiences with today's students.

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The Effects of Response Constraints and Message Labels on Interaction Patterns and Argumentation in Online Discussions

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Abstract

This study tested the effects of constraint-based argumentation in threaded discussions. In one group, students posted messages using prescribed response categories. In another group, students pre-classified messages by inserting response labels into message headings, enabling students' to examine the structure of their arguments. The control group conducted debates with no knowledge of the response categories and no message labeling. Using event sequence analysis to identify interaction patterns in the threaded discussions of each group, this study found that message labeling reduced the proportion of arguments challenged by the opposing team and as a result, reduced the proportion of arguments elaborated with explanations. Message labeling may have heightened the perception of critical responses as excessively confrontational among the mostly female participants.

Introduction

Numerous studies have demonstrated that online learning environments provide better opportunities for more learner-to-learner interaction and facilitate more reflective and critical thinking within learning communities (Ravits, 1997; Collins & Collins, 1996; Ward & Tissen, 1997). Argumentation is recommended as one of the collaborative inquiry-based learning strategies to increase student critical thinking skills in online settings (Derry et al., 2000). These skills involve the processes of building arguments to support a position, and considering and weighing evidence and counter-evidence in developing supporting arguments.

Various techniques have been developed to scaffold argumentation in online discussions. Derry et al. (2000) suggested specific tools that reduce the difficulty of teasing out argumentative structures in group interactions to support better understanding of task-related mental structures and arguments. The ability to visualize the complex discourse structures can ultimately support problem solving and learning communications (Turoff & Hiltz, 1998). Such tools can perform some part of the tasks for students but also assist students' abilities by changing the nature or difficulty of the task (Cho & Jonassen, 2002). Among the tools that have been found to support argumentation, structural scaffolding is provided by constraining the types of messages that can be posted and requiring students to pre-classify or label messages by function using prescribed response labels (Duffy et al., 1998; Cho & Jonassen, 2002). For example, the Belvedere system (Suthers, 1998; Suthers et al, 2002) presents a constraint-based argumentation scaffold consisting of predefined argumentation constraints (hypothesis, data, principles, and unspecified) and links (for, against, and).

To improve our understanding of constraint-based computer-supported collaborative argumentation (CSCA), these tools must be examined under controlled experiments. Current CSCA research has focused primarily on graphical tools that support collaborative production of concept/knowledge maps (Suthers, 1998; Cho & Jonassen, 2002, Veerman, Andriessen & Kanselaar, 1999; Buckingham-Shum, MacLean, Bellotti & Hammond, 1997; Suthers & Hundhausen, 2001). These studies compare the effects of graphical tools to other communication tools such as chats and asynchronous bulletin boards used *without* argumentative scaffolds. At this time, no studies have compared the effects of threaded discussion tools with versus without constraint-based argumentation. Previous studies on threaded discussions with constraint-based argumentation and labeled messages are limited to findings from evaluation reports (Duffy, Dueber & Hawley, 1999; Sloffer, Dueber & Duffy, 1999) and not from controlled experiments.

The purpose of this study was to examine how constraint-based argumentation with labeled messages affect students' interaction patterns and argumentation processes in online threaded discussions. Using a controlled experimental design to examine the effects of response constraints and labeled messages, the objectives of this study were to compare the following outcomes:

1) relative frequency of arguments, supporting evidence, challenges to arguments, and explanations for clarifying or elaborating stated arguments.
2) overall level of interaction and the response rate to messages.

3) interaction patterns and percentage of arguments and critiques that elicit responses with supporting evidence, critiques from the opposition, and explanations.

Method

Participants. In this study, forty-three pre-service teachers participated in a series of five weekly debates on five educational issues. The students were largely undergraduate students enrolled in a course on educational technology.

Treatment Groups. Students were randomly assigned to three treatment groups consisting of 15 students per group. Within each group were two male and thirteen female students. In control group 1, students received no instructions or constraints on the types of messages they could post to the debates. Students in group 2 were presented with a prescribed set of response categories - arguments, evidence, explanation, critique, and other process comments - used as a guideline on how to contribute to the debates (see Figure 1). In group 3, students received the same prescribed response categories, but were also required to insert corresponding labels into the subject headings (see Figure 2). The labels enabled students to see the structure of their arguments when viewing the discussion threads.

Students were required to post a minimum of four messages per week. Within each group, students were assigned to a team to either support or oppose a position. In each debate, students debated issues that explored the appropriate use of educational technology. For example, students debated the position "Computers can substitute the role of the instructor for kids in the future".

Data Analysis. Previous studies that examine interaction patterns in online discussions have used content analysis (Gunawardena et al., 1997; Newman, 1995; Levin, Kim & Riel, 1990) to gather simple event frequencies for comparing treatment groups. This study applied a more advanced approach to examining interactions by using event sequence analysis (Bakeman & Gottman, 1997) to identify patterns in message-response exchanges. Using event sequence analysis, this study identified prevalent patterns (see Figures 3) in message-response sequences by: 1) counting the frequency of specific responses to each type of message; 2) converting the response frequencies into transitional probabilities for each observed message-response interaction, e.g. probability of an argument eliciting a critical response versus a response with supporting evidence; 3) testing the statistical significance and strength of observed transitional probabilities to determine if they were significantly higher or lower than expected probabilities; and 4) translating the transitional probabilities into transitional state diagrams (see Figure 4) to provide a visual birds-eye view of interaction patterns. The analysis also included relative frequencies and response rates for each response category. The analysis and state diagrams were computed and generated with the Discussion Analysis Tool (Jeong, 2003).

The discussion transcripts in Groups 1 and 2 were classified by two coders. Cohen's kappa was calculated to establish inter-rater reliability of the coding. The reliability of the codings were very good for group 1 (k = .82) and group 2 (k=.87). The assessment was determined based on consensus between coders. Decisions about messages with different codes were reconciled in discussions between the coders. In group 3, messages were labeled by the students themselves. As a result, one coder classified the messages and a comparison of the coder's classifications with the students' classifications also produced a very good inter-reliability of k = .804.

Theoretical Assumptions. The justification for examining the transitional probabilities between messages and responses is based on the assumptions of dialogic theory (Bakhtin, 1981). The theory posits that all possible meanings of a word interact, possibly conflict, and affect future meanings. Meaning is produced by the relationship between one utterance and another, and not by the utterance alone. Meaning is therefore affected, re-negotiated and reconstructed as a result of conflict arising from social interaction and "dialogic reasoning" (Sappo & Mononen-Aaltonen, 1998). As a result, the construction of knowledge depends on specific processes and social interaction patterns such as argument-critique, critique-explanation and argument-evidence.

Results

Relative Frequencies. The number of postings in Groups 1, 2 and 3 were 207, 300 and 265 respectively. These findings suggest that the use of constraints or prescribing response categories to scaffold argumentation may have helped to generate more postings. In addition, the results in Figure 5 suggest that message labeling in Group 3 helped to produce proportionately more arguments and evidence than Groups 2 and 3. Group 3 posted proportionately more arguments (.52) than Group 1 (.27) and Group 2 (.35). Group 3 posted proportionately more evidence (.23) than Group 1 (.05) and Group 2 (.05). However, Group 3 posted fewer critical responses to arguments (n = 30), and fewer explanations to elaborate on arguments (n = 27). Group 1 posted 70 critiques and 70 explanations, and Group 2 posted 97 critiques and 79 explanations.

Response Rates. The overall response rates to posted messages for Groups 1, 2 and 3 was .63, .60 and .56. This finding suggests that the use of prescribed response categories can reduce interaction between students given the response rates in the control Group was greater than the response rates in Group 2. The addition of message labeling in Group 3 may have further reduced the level of interaction. As a result, the previous finding that message labeling and constraint-based argumentation may produce more arguments and evidence must be tempered by its negative effects on the level of interaction needed to engage students in argumentative exchanges.

Interaction Patterns. Comparing the state diagrams in Figure 4 shows that Group 3 engaged in substantially fewer ARG→CRIT exchanges than Groups 1 and 2. No apparent differences were found between Groups 1 and 2 because students in Group 2 were not given strict instructions to restrict messages to the prescribed response categories. Of the responses to arguments in Group 3, only .12 of responses challenged the basis of the arguments compared to .45 in Group 1 and .44 in Group 2. The diagrams also show that a substantially smaller proportion of responses to arguments were elaborated with explanations (ARG→EXPL) in Group 3 (.07) compared to Group 1 (.42) and Group 2 (.42). The low number of explanations can be attributed to the low number of critical responses to arguments given the assumption that only when something appears to be wrong that the need to explain and understand is felt and acted upon (Baker, 1999). In other words, the ARG→CRIT interactions serve as events that trigger explanations which in turn can lead students to a better understanding of arguments.

The low rate of ARG→CRIT interactions in Group 3 may have resulted from the use of particular labels or sequence of labels (e.g. ARGo→CRITs, ARGs->ARGo) that heightened the perception of particular responses as personally and excessively critical and confrontational. Students may have avoided posting critical responses so as not to be perceived by other students as aggressive or dominating. This particular response to labels may be largely attributed to the nature of the group composition in which the majority of students were female. Studies have found males to be more likely than women to engage in argumentation, confront differences in opinions, and defend viewpoints (Tisdell, 1993; Vanfossen, 1998). Women tend to engage in more relational communication patterns that are supportive instead of confrontational (Tannen, 1990). This is consistent with the findings in Group 3 where the postings were mostly arguments and evidence posted in support of team positions. In another study that used message labeling (Jeong, 2003b), females were less likely than men to post critical responses, but only when responding to messages from females and not males. Interaction between genders helped generate more ARG→CRIT and ARG→EXPL interactions.

Discussion

Previous studies have shown that constraint-based CSCA can improve argumentation when applied with concept mapping tools. This study however found that constraint-based argumentation with labeled messages in threaded discussions can inhibit argumentation. Although the results in this study show that labeled messages produced more arguments and evidence, labeling reduced overall interaction between students and reduced the number of critical responses to arguments and evidence. As a result, this study found that labeled messages in threaded discussions can inhibit interaction and critical analysis of arguments.

Although these findings can be largely attributed to the female response to labels, the findings nevertheless has important implications. Many concept mapping tools support argumentation without labeling the nodes and identifying its authors. As a result, constraint-based discussion boards could be implemented in the same manner by requiring students to pre-classify messages without displaying labels and author's identity. Despite the findings in this study, labeled messages has the potential to help students examine the structure of arguments in discussions threads and quickly locate points of disagreement in order to foster more in-depth discussions. Message labeling also has the potential to be a practical method for collecting ever larger corpus of data for future research on collaborative models and processes. The problems identified in this study must be addressed to allow further exploration of the potential advantages of labeling as an instructional and research methodology.

Some solutions to the problems identified in this study, when implemented and manipulated in controlled experiments, suggest directions for future research. Some of these solutions include the following: implement anonymous discussions, include labels that are facilitative and gender neutral, ensure more gender-balanced discussion groups, implement additional constraints on message-response sequences to ensure more argumentative exchanges, and assess performance to set appropriate expectations and encourage more argumentative exchanges between opposing viewpoints.

Figure 1 Response categories used to scaffold and label messages for argumentation

ARG	Argument in support of the proposition. For example, "Computers can substitute the role of the instructor when kids use computer-based tutorials". The subject heading for this argument might be something like "ARGs computers as tutors"
EVID	Evidence, specific examples, research studies, personal observations & experiences, or proofs. For example "I found an article that shows that..." or "In one course, I used a computer tutorial and I found that....". The subject heading for these messages might be "EVIDs study finds tutorials to be effective".
CRIT	Challenge or critique given arguments, evidence or any other responses from the opposing team. For example, "The personal experiences you've had with computer-based tutorials cannot be generalized to other students because ...." or "The study you cited was flawed because..."
EXPL	Explanation, elaborations or clarifications. For example "Computer-based tutorials perform the specific role of assessing students understanding just as an instructor can administer pop quizzes in a classroom".
OTH	Other process comments or questions or requests for help, such as "What is a computer-based tutorial?" or "Thanks for responding to my message" or "I think we need to provide more evidence, such as journal articles, textbook readings, personal observation & experiences from past courses, to show that computer-based tutorials perform just as well as an instructor?" or "What exactly did you mean when you said that....?" or "Can you give me more evidence?"

Students were also required to insert tags ('o' = opposing, 's' = supporting) at the end of each label to identify postings from the opposing versus the supporting team. For example, ARGs for an argument from the supporting team and CRITo for a critical response from the opposing team.

Figure 2 Illustration of threaded discussion forum for Group 3 with prescribed response categories and labeled messages

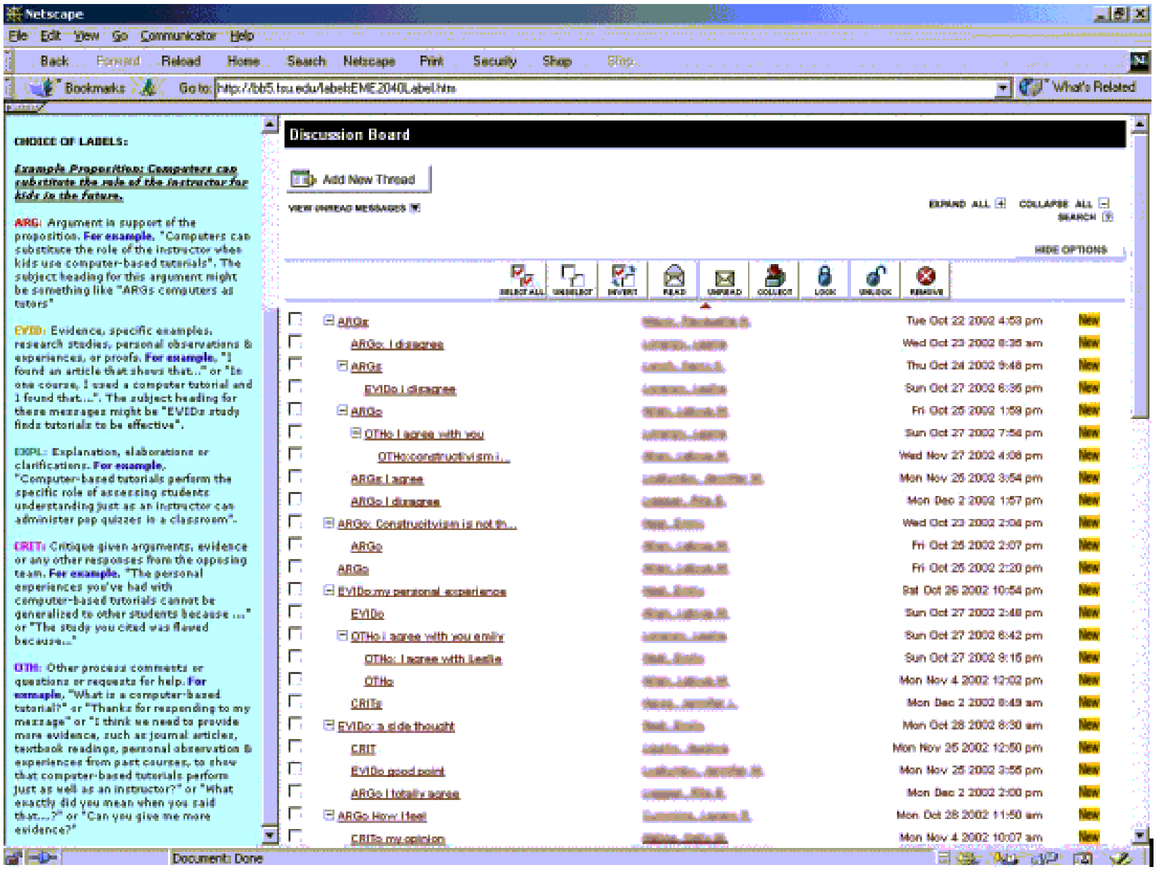


Figure 3 Event sequence matrices containing observed response frequencies, transitional probabilities and Z-scores values for Group 3 using constraint-based argumentation with message labeling

	ARG	EVID	CRIT	EXPL	OTH	Replies	No replies	Givens	%Replies	%Givens	Reply rate
ARG	56	4	10	6	6	82	59	137	.57	.52	.57
EVID	4	8	4	1	3	20	13	32	.14	.12	.59
CRIT	2	0	7	3	1	13	13	30	.09	.11	.57
EXPL	6	2	3	6	1	18	9	27	.12	.10	.67
OTH	1	0	3	0	8	12	23	39	.08	.15	.41
	69	14	27	16	19	145	117	265	--	--	.56

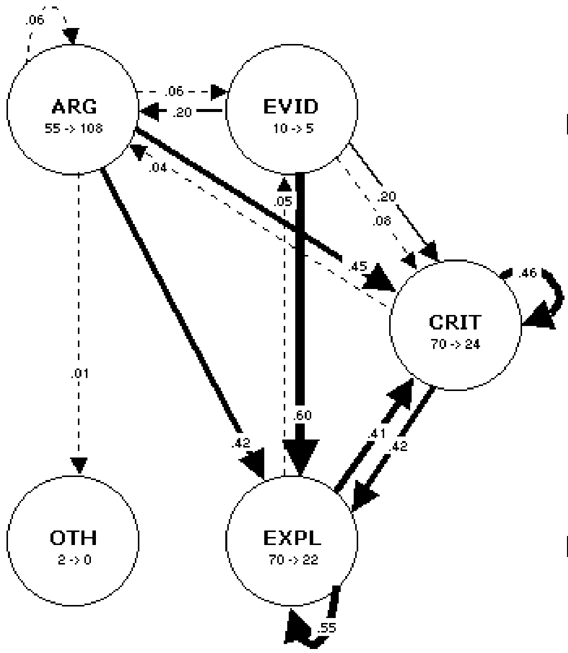
	ARG	EVID	CRIT	EXPL	OTH
ARG	.68	.05	.12	.07	.07
EVID	.20	.40	.20	.05	.15
CRIT	.15	.00	.54	.23	.08
EXPL	.33	.11	.17	.33	.06
OTH	.08	.00	.25	.00	.67

	ARG	EVID	CRIT	EXPL	OTH
ARG	**5.70**	**-2.22**	**-2.27**	-1.63	**-2.36**
EVID	**-2.66**	**4.95**	0.17	-0.93	0.27
CRIT	**-2.44**	-1.24	**3.42**	1.45	-0.61
EXPL	-1.29	0.22	-0.23	**3.23**	-1.01
OTH	**-2.84**	-1.18	0.59	-1.27	**5.74**

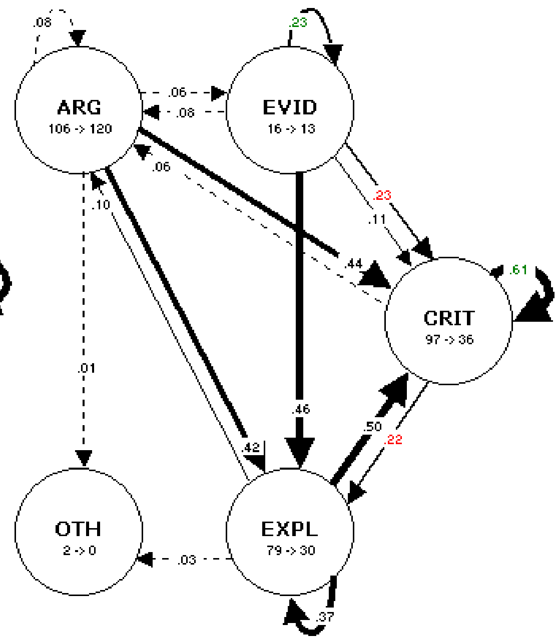
Z-scores < -1.95 and > 1.95 identify transitional probabilities that were significantly below and above, respectively, the expected probabilities based on random chance alone at alpha = .05.

Figure 4 The transitional state diagrams for all three groups, summarizing the observed frequency of responses, transitional probabilities between message- response interactions, and z-score tests for probabilities significantly higher and lower than expected probabilities

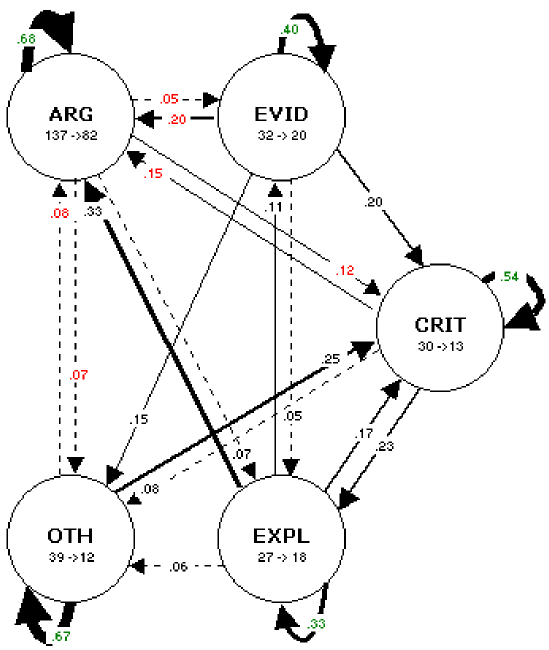
Group 1 – Control group



Group 2 – Constrained by Response Categories



Group 3 – Constrained by response categories with message labeling



Each node in the diagrams represents a specific response/message category. The lines connecting the nodes illustrate the strength of the transitional probabilities between message and responses. The probabilities displayed in green and red designate probabilities that were significantly higher and lower, respectively, than the expected probability based on z-score values (alpha = .05). Within each node are the observed frequencies of the given message followed by the total number of observed responses to the given message.

Figure 5 The proportion of messages and responses for each response category by group

	Group 1		Group 2		Group 3	
	Messages	Responses	Messages	Responses	Messages	Responses
ARG	.27	.68	.35	.60	.52	.57
EVID	.05	.03	.05	.07	.12	.14
CRIT	.34	.15	.32	.18	.11	.09
EXPL	.34	.14	.26	.15	.10	.12
OTH	.01	.00	.01	.00	.15	.08

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Instructional Design in the Real World

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Instructional Design in the Real World

Many instructional design (ID) tools and methods evolved during the 1940s, 50s, and 60s (Reiser, 2001). In the 1970s, these methods were solidified in several classic instructional design models. In the 1980s, instructional design continued to flourish, fueled by the introduction of personal computers and advances in cognitive psychology. However, during the 1990s, the field was challenged by new developments (Gustafson & Branch, 1997; Reiser, 2001). The performance technology movement pushed corporate training departments to consider other kinds of interventions instead of relying on instruction to solve performance problems. Proponents of the constructivist movement in education harshly criticized the use of behavioral objectives and other strategies that served as foundations for the field. To rein in e-learning development expenses, designers began to create prototypes before committing to costly full-scale production. Despite these challenges, the need for instructional design and development skills increased as "just-in-time" electronic performance support systems, distance education, and instructional applications of the Internet all exploded.

However, researchers have discovered that practicing instructional designers seldom perform all the steps prescribed by classic instructional design models (Rowland, 1992; Wedman & Tessmer, 1993; Wiener & Vazquez-Abad, 1995). In response to these findings, several authors have called for the development of a "practitioner's model" that reflects current practices (Tessmer & Wedman, 1990; 1995).

In this article, we present instructional design as we practice it and as we see our peers practice it. This "practitioner's model" has evolved from the literature on instructional design and an extensive examination of design artifacts from more than 20 years of combined experience in academic and corporate settings. Design artifacts ranged from macro-level documents such as project proposals to micro-level documents such as meeting agendas and storyboards. Through the process of continually looking at the research of others (for example, Rowland,1992; 1993; & Wedman, 1990; 1993; 1995), examining documentation of design decisions and design artifacts, and active conversing and reflecting on the processes we saw represented there, we have outlined a model of design that we feel accurately represents the way instructional design is practiced in the "real world".

Unlike the crisply delineated, step-by-step instructions found in cookbooks, we know that instructional design resists a tidy, easily replicated solution. Each instructional design project is, by definition, creating new work. If the work is not entirely new, perhaps the content is new, or there's a new group of learners, or the delivery system has changed, or perhaps several things have changed. If nothing has changed, there wouldn't be a need to do anything to the material. So instructional design isn't similar to making banana bread – you can't follow the same instructions in the same way each time and get equally great results.

We agree that design involves problem solving (Rowland, 1993). As the designer works on a project, he or she collects information and makes tentative hypotheses about solutions. Expert designers often use a "template" to provide a mental framework for collecting this information and then fill in the "slots" with information (Rowland, 1992). Eventually, the designer reviews which slots are filled and which still need to be figured out. At some point the designer will find there's nothing more to add, either because experts and resources have yielded all the information that's needed, or because of time or budget constraints. Throughout the process, the designer makes tentative decisions, develops design documents and other products, presents them to the client for feedback, and then revises them based on that feedback.

We divide this knowledge-building cycle into five phases of instructional design: Define, Design, Demonstrate, Develop, and Deliver. Running through the five phase are five essential elements that form the building blocks to systematically designed instruction: learner needs and characteristics, goals and objectives, instructional activities, assessments, and evaluation. Instructional designers must create instruction *with* others as well as *for* others. Various team members come from different professional cultures, each with their own set of expectations, vocabulary, timelines, rewards, and consequences. Designers need more than a step-by-step model to prepare them for the collaboration required to successfully solve instructional problems in the team environment in which most designers work.

Critical questions: The essential elements of instructional design

Rowland (1992) suggests that instructional designers focus on asking good questions, rather than simply following the "steps" prescribed by traditional instructional design models. Throughout the instructional design process, instructional designers need to consider factors that impact the success of the instruction. These factors, or elements, are the component parts of instructional design and can be thought of as a set of questions. The answers to those questions inform the results of the design process. The design process starts with these considerations:

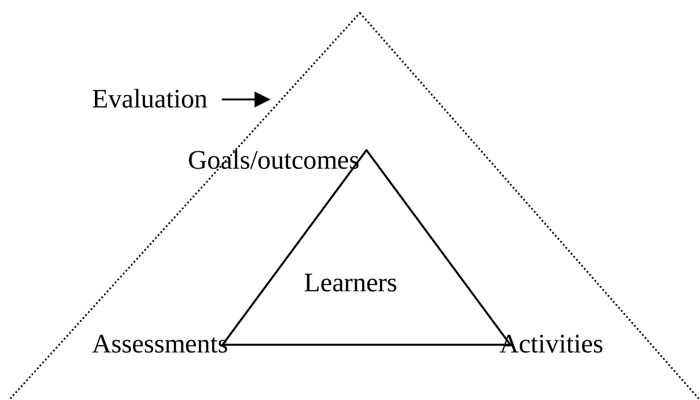
1. What are the learners' information needs, prior experiences, beliefs, and values relative to the topic of instruction? Instructional decisions should be made based on what we know about the *learners'* characteristics and informational *needs*.
2. What changes in thinking or performance do we want to occur? How will we know if these changes have occurred? How will we provide opportunities for learners to engage in activities that may stimulate changes in thinking or performance? The designer examines these questions, determining the *goals*, *assessments*, and *activities* of the instructional intervention, recognizing that to be effective, instruction requires a match among the goals, assessments, and activities.
3. How do learners respond to the materials? Are they effective? Good instruction is instruction that has been tested with a group of learners prior to distribution, and modified based on the results of a pilot test or formative evaluation.

In examining these issues, we define the learners, their needs, the instructional objectives, the assessment, the instructional activities, and the evaluation. As instructional designers, our task is to ensure that:

- Instruction is designed to meet the *needs* and characteristics of the *learners.*
- The *goals*, *activities*, and *assessments* of instruction are in alignment.
- The instruction has undergone *formative evaluation* prior to distribution.

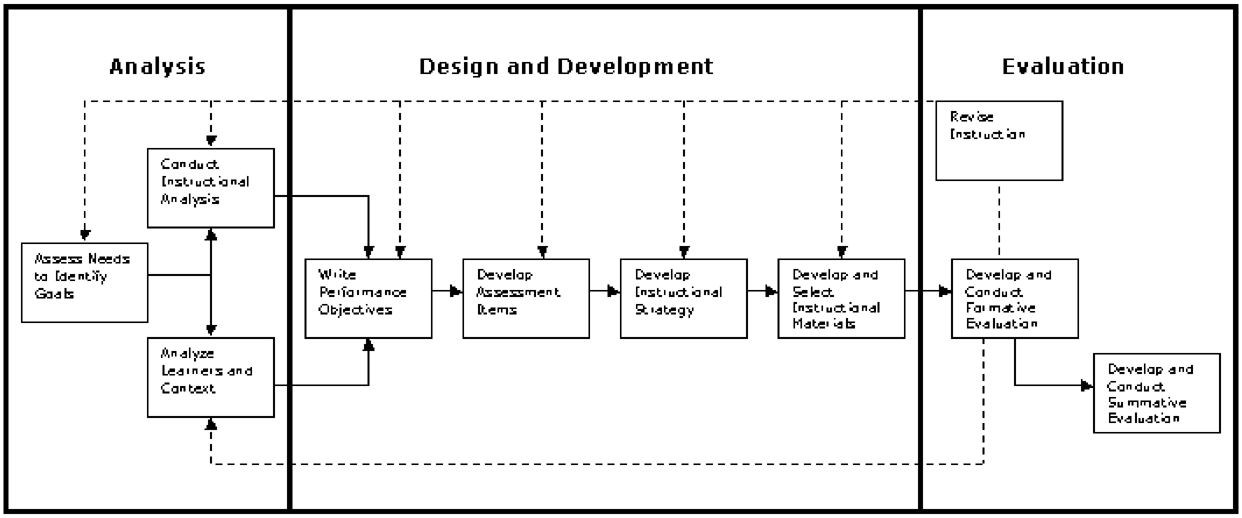
The relationship among these key ideas is illustrated in Figure 1.

Figure 1. The Essential Triangle of Instructional Design



These five essential elements are addressed in almost all instructional design models (Gustafson & Branch, 1997). Where traditional instructional design models include discrete stages for defining each of these element (for an example of one popular model, see Figure 2), we find that most projects unfold in a spiral rather than a linear fashion. Most traditional instructional design models require the designer to determine needs before writing objectives, write objectives before assessments, and assessments before the instructional strategy. That's a fine strategy but we find that, in practice, designers actually might start by seeking answers to any or all of these questions.

Figure 2. The Dick and Carey model



Knowledge-building cycles: phases of instructional design

As the we cycles through the stages of Define, Design, Demonstrate, Develop, and Deliver, we revisit the elements of the essential triangle again and again. Instead of addressing each of these elements in a set sequence, each of the elements is considered in each phase, building on the knowledge gained in previous phases. Throughout the design process, the designer reconsiders the elements, revising and refining them as he or she develops a deeper understanding of the audience, the outcomes, and the activities. As the spiral tracks the project through each of the phases, we move from a vague vision to a concrete, effective product.

Figure 3. The phases of instructional design

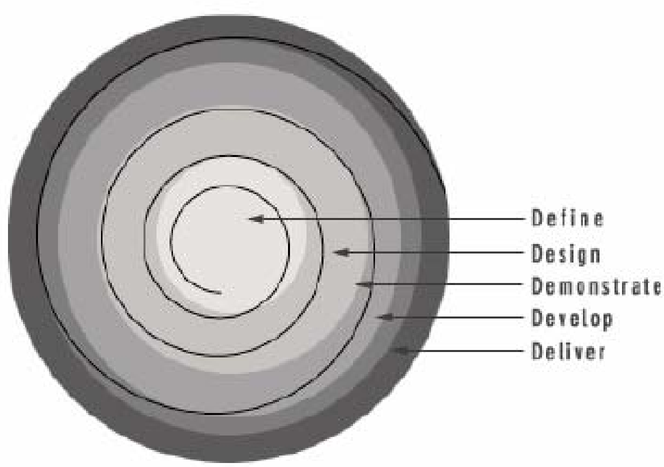


Fig A. The development process.

In the Define phase, we begin to determine the *learners*, the *needs*, the overall *goal*, potential benchmarks of success (*assessments*), the *product*, and begin to think about how to determine if the program is effective (*evaluation*). This stage results in a Project Proposal.

The Design phase involves the major planning effort to provide crisper *audience definitions*, confirmation of instructional *needs*, goals converted to high-level *objectives*, benchmarks converted to *assessment plan*, general activities converted to content and *instructional strategies*, and a plan for prototype testing and *formative evaluation*. This stage results in Instructional Design Documents.

In the Demonstrate phase, we continue to develop design specifications and to ensure quality as the preliminary media production begins. This includes determining that the materials, in development, are appropriate for the *learner*s; monitoring development of materials to ensure they meet audience *needs*; making sure activities meet *objectives*; ensuring *assessments,* included as planned, align with the *materials,* which match the instructional strategy as designed; and *testing* the prototype with a small group of learners to get feedback prior to large-scale development. This stage results in detailed Production Documents such as storyboards and templates and a prototype consisting of a "slice" of the instructional materials. This is a logical time to begin to evaluate the instruction. The evaluators consider the degree to which the materials met the audience *need*, whether materials were appropriate for the *learners*, whether *objectives* were met, whether *assessments* were clear and appropriate for materials, and whether *materials* were implemented as planned and run smoothly.

As we work with the production team during the Develop phase, we continue to serve as an advocate for the learner. This includes reviewing the feedback from the prototype testing and making any changes to the product as needed. This phase also requires that we ensure that materials are appropriate for the *audience characteristics* and *needs*, activities meet *objectives*, *assessments* are included as planned, and *materials* match the strategy as designed. This phase results in a complete set of instructional material, which may undergo additional evaluation in field trials..

Finally, we reach the Deliver phase, presenting the materials to the client, possibly training the client team on the product, and making recommendations for future development. If there is be a *summative evaluation*, the client and evaluator needs to consider the degree to which the materials met the audience *need*, whether materials were appropriate for the *learners*, whether *objectives* were met, whether *assessments* were clear and appropriate for materials, and whether the *materials* were implemented as planned and run smoothly. This phase results in the successful conclusion of this instructional design project and, hopefully, the beginning of a long and fruitful relationship between the client and the design team.

We've found that as we revisit the same elements, at different times, for different purposes, ideas generated in previous phases are built upon in iterative, knowledge building cycles (Rowland, 1992).

"While [traditional] models may have iterative features that allow for a reconsideration of earlier design activity outputs, they emphasize closure of each component in the process to serve as input to the next component. A layered approach assumes that components of the ID process will be repeated to a greater degree of precision and sophistication in subsequent layers of the process. This repetition is not for the purpose of revision earlier components ... but of adding onto the work that was done earlier" (Tessmer & Wedman, 1990, p. 80).

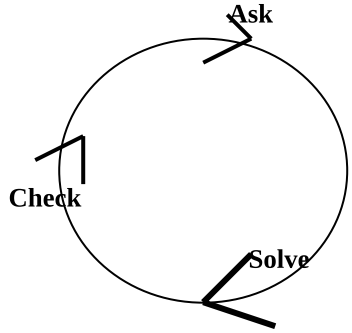
Decisions are not revisited in order to stall progress; on the contrary, decisions are revisited to allow us to move on. In this process, decisions are made, but often must be made quickly, before all of the relevant factors are known. Instructional designers must generate hypotheses and makes "best guess" decisions in order to move forward, then confirm or revise those decisions as their understanding grows. In terms of a spiral, in the initial phase, we've found that the designer's understanding of the material is tiny, like the tight inner coils of the spiral. As the project moves through subsequent phases, the designer often revisits the same material but brings greater understanding each time, moving finally into outer layers of the spiral.

Design as collaborative practice

We talk about the cyclical nature of instructional design, spiraling through stages and seeking deeper and deeper understanding of key questions. But how does a designer move from one stage to another? How do we gain that deeper understanding of each of the key elements of design? Throughout the design process, we consider each of the essential elements of design. We spiral through the various phases of the design and development project, increasing our understanding as we spiral outward. The process through which we increase our understanding can be thought of as a collaborative "ASC cycle" (see Figure 3) because we:

- **A**sk questions
- **S**olve problems, and
- **C**heck for understanding.

Figure 4. The collaborative cycle



Each phase begins with ***asking*** for certain information. The instructional designer has many, many conversations. In those conversations, the role of the instructional designer is to derive information that is applicable to answering the essential questions of design: Who are the learners? What are their needs and characteristics? What do they need to know? How can we tell if they know it? What activities can we provide to increase the probability of these learners gaining this knowledge? We assemble documents, observe processes and use other means to gather the information we need to create tentative solutions. We have conversations with a variety of people who can help answer these questions.

We collect information and then retreat back to our "design shop", desk, or laptop, and begin to make sense of the information we've gathered relative to the design process. Along with the instructional design team, we begin to generate tentative solutions. Under the best of circumstances, the ideas generated will be elevated to a level that could never have happened when working in isolation. Through "synergy", the ideas produced by the group will be more than the sum of it's parts. As we make sense of the information, we begin to create the deliverables of each stage in the design process: the project proposal at the Define phase, the design documents in the Design phase, the production documents and prototype in the Demo phase, the instructional materials in the Develop stage, and the complete instructional package in the Deliver phase.

And at each stage, we check our tentative understanding through presenting the deliverables to others for input as to whether our interpretation, as manifest in the deliverables of each phase, is on target for the client, SMEs, and learners. We evaluate our ideas when we present a project proposal for consideration. We evaluate our "best guess" solutions when we present design documents for discussion, when we present storyboards, content outlines, and prototypes. We are confirming or modifying our design decisions and the products of these decisions, throughout the Define, Design, Demonstrate, Develop, and Deliver cycles.

As we check our understanding as instructional designers, we gain additional information that will move us to the next phase in the instructional design process. We negotiate a contract in the Define stage that leads us to the Design phase. We gain approval of Design documents in the Design phase that allows us to begin creating more detailed representations of the instruction in the Demonstration phase. We gather input from clients, learners, and SMEs in the Demonstrate phase that allows us to move into the Develop phase. And as we gain approval of the materials developed, we Deliver the materials to our clients and learners.

Instructional design projects often involve a client, a subject matter expert, and one or more individuals with specific media production skills, in addition to the instructional designer. The designer may need to interact with members of the target audience or other individuals who are familiar with the learners' needs and characteristics. Collaborative interactions with these various groups serve three primary purposes:

- to provide answers to the key questions of design
- to allow solutions to emerge that would not emerge in isolation (through synergy)
- to confirm or modify our understanding

As we spiral through the essential questions of design—the elements—at increasing levels of specificity, we move through the phases of Define, Design, Demonstrate, Develop, and Deliver.

Summary

Recent trends suggest that instructional design models should reflect the way instructional practitioners implement design and remain responsive to the needs and constraints of the workplace. Consistent with these trends (Gustafson & Branch, 1997; Tessmer & Wedman, 1995), this model presents instructional design as a holistic, collaborative process, acknowledges the concurrent nature of design practice, and supports the creation of scenarios, rapid prototypes, and other concrete means to move the design team forward. Three key ideas run throughout this view of instructional design:

- Design involves conversations around critical issues (represented as five *elements* of design).
- Design is an iterative knowledge-building cycle (represented as five *phases* of design).
- Design is a *collaborative* activity among individuals representing different perspectives and expertise (represented as the ASC cycle).

We believe this spiral model represents the iterative, knowledge-building manner in which instructional design is actually practiced. We accept the fact that different people may do the task differently, and in fact, there may be many, many ways of arriving at an effective product. Although there may be no one "right way" to design instruction, there are most likely themes that run through effective design efforts. We invite you to share stories and anecdotes of your design experiences so that as a profession, our models can better reflect the way we do our business. We see this model not as the "answer" but as the beginning and welcome your comments using the contact information provided on the front of this paper.

Instructional design as a discipline has evolved over almost 60 years. The tools and techniques of practice continually adapt to new methods of delivering instruction and new developments in educational psychology. As research continues to yield information about how we actually practice our craft, our models will adapt to reflect that reality. As the field of instructional design continues to grow and respond to the needs of education and training, developments in delivery methods that demand our skills, and research and theory from educational psychology that inform our instructional strategies, we will remain a responsive, influential, and valuable contributor to society.

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Designing Electronic Collaborative Learning Environments

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Current research and design of collaborative learning environments - often referred to as Computer Supported Collaborative Learning (cscl) Environments - tends to focus on surface level characteristics. Educational researchers and designers are busy, for example, determining optimal group size for problem-based education as opposed to project-centered learning. To determine optimal group size, students' collaborative efforts and the results of these efforts are compared for groups of varying size in the different educational settings. This approach resembles comparative research on the use of different media in education that was strongly - and we had hoped definitively - criticized by Clark (1983). He eloquently argued that researchers tend to focus on the media used and surface characteristics of the education they provide. As a consequence, comparative research tends to be inconclusive and the learning materials developed tend to be unreliable at best and mathemathantic (from the Greek: mathema=learning + thanatos=death) at worst. This surface level approach disavows the fundamental differences between the real determinants of learning and behavior in education.

A second problem is that educational institutions tend to apply traditional classroom ideas and pedagogy in non-contiguous collaborative learning environments, assuming that since these environments allow the interaction that we see in the classroom (e.g., chat, real-time meetings, shared applications) traditional pedagogy can be used. The proximate result is often disgruntled or disappointed students and instructors, motivation that is quickly extinguished, poorly used environments, wasted time and money, and showcase environments that are often not much more than computer assisted page turning. The ultimate result is the same as by the first problem, the death of learning.

The solution is as simple as it is elegant, attending not only to technology, but also to the educational and social prerequisites for collaboration. This article provides a framework for designing such collaborative environments based upon the three prerequisites. It then goes into somewhat greater dept with respect to three non-surface level educational factors central to collaboration, namely task ownership, task character and task control. Finally, it presents empirical research on the affordances

Affording Collaboration

Instructional design is deterministic or causal in that it tends to focus on individual learning outcomes and tries to control instructional variables to create a learning environment that supports the acquisition of a specific skill (a certain person will acquire a specific skill through the implementation of a chosen learning method). With collaboration, the use of groups complicates this. Here, individual and group level variables affect the collaborative learning process such that it is nearly impossible to pre-define conditions of learning or instruction for a group setting such that interaction and skill acquisition are controlled.

Instead of a classic causal view, design of collaborative settings requires a more probabilistic view on design. This distinction corresponds with the one made by Van Merriënboer and Kirschner (2001) between the 'World of Knowledge' (outcome) and the 'World of Learning' (process). In the world of knowledge, designers construct methods by which given learning goals in a specific subject matter domain can be attained by the learner. In the world of learning, designers focus on methods supporting learning processes, and not so much attainment of pre-defined goals.

This probabilistic view implies that more attention needs to be paid to learning and interaction processes. Due to the interactions between learners, each person in a group may acquire a given skill through the chosen method, but may equally likely acquire only a part of the skill or the skill and something unforeseen. It might even be the case that the chosen method is abandoned by the group and replaced by another, more idiosyncratic method for that group. The question is not what specific educational techniques and collaborative work forms cause, but rather what they actually afford, also often referred to as the affordances of a learning environment.

What now are these affordances? Simply stated, they are the perceived and actual fundamental properties of a thing that determine how the thing could possibly be used (Norman, 1988, p. 9). Affordances are most visible in real life. Some door handles, for example, look like they should be pulled. Their shape leads our brains to believe that is the best way to use them. Other handles look like they should be pushed, a feature often indicated by a bar spanning the width of the door or even a flat plate on the side. Gibson (1977) originally proposed the concept of affordances to refer to the relationship between an object's physical properties and the characteristics of an actor (user) that enables particular interactions between actor and object. "The affordance of anything is a specific combination of the properties of its substance and its surfaces with reference to an animal" (Gibson, 1977, p. 67). These properties/artifacts interact with potential users and may provide strong clues as to their operation. In our view, the concept of affordances offers an alternative framework for designing and evaluating iecles if appropriated to the educational context.

Education is always a unique combination of technological, social, and educational contexts. Take typical classical education and group learning. The educational contexts are competitive vs. collaborative, the social contexts are individual vs. group, and the technological (physical) contexts are individual workspaces with minimal assortment of materials vs. group workspace with a rich assortment of materials. CSCL represents yet another learning situation. The educational context is collaborative, the social context is the group, and the technological context is a computer-mediated one. The Open University of the Netherlands, for example, uses a computer-mediated communication environment (technological) for competence-based learning grounded in social constructivism (educational) with minimal direct contact, maximal guided individual study, and primarily asynchronous, text based contact between students (social).

When technology mediates the social and educational contexts such that their properties induce and allow specific learning behaviors we speak of ‘technology affording learning and education’. This means that we must hold count with technological, social, and educational affordances.

Technological Affordances

Norman (1988) related perceived affordances to the design aspects of an object suggesting how it should be used: “Design is about [real and perceived affordances], but the perceived affordances are what determine usability” (Norman, 1998, p. 123). Norman links affordances to an object’s usability, and thus these affordances are designated technological or technology affordances (Gaver, 1991). Usability is a well known objective of industrial or product design dealing with physical objects ranging from video-recorders to teapots, and human-computer interaction (hci) dealing predominantly with graphical user interfaces composed of interface objects such as buttons and scrollbars. It is concerned with whether a system allows for the accomplishment of a set of tasks in an efficient and effective way that satisfies the user (e.g., Preece, Rogers, Sharp, Benyon, Holland, & Carey, 1994). It is not a single dimension, but deals with ease of learning, efficiency of use, memorability, error frequency and severity, and subjective satisfaction (Shneiderman, 1998). When creating such environments it is, therefore, important to consider these aspects. Otherwise we risk creating iecles that contain all the needed educational and social functionality (in Nielsen’s (1994) terms ‘utility’), but that cannot be handled by their users (i.e., the learners) because they are difficult to learn, access, and/or control in the same way video-recorders are.

Social Affordances

Kreijns, Kirschner, and Jochems (2002) define social affordances - analogous to technological affordances - as the “properties of a cscl environment that act as social-contextual facilitators relevant for the learner’s social interaction” (p. 13). Objects that are part of the environment can realize these properties; hence they are designated social affordances devices. When social affordances are perceptible, they invite learners to engage in activities that are in accordance with these affordances, that is, there is social interaction.

In the ‘physical’ world, affordances abound for casual and inadvertent interactions. In the ‘virtual’ world, social affordances must be planned and must encompass two relationships. First, there must be a reciprocal relationship between group-members and the environment. The environment must fulfill the social intentions of members as soon as these intentions crop up while the social affordances must be meaningful and support or anticipate those social intentions. Second, there must be a perception-action coupling. Once a group-member becomes salient (perception), the social affordances will not only invite, but will also guide another member to initiate a communication episode (action) with the salient member. Salience depends upon factors such as expectations, focus of attention, and/or current context of the fellow member.

Educational Affordances

Kirschner (2002) defines educational affordances as those characteristics of an artifact that determine if and how a particular learning behavior could possibly be enacted within a given context. In other words, the chosen educational paradigm – the artifact – is instrumental in determining if and how individual and team learning can take place. Educational affordances can be defined - analogous to social affordances - as the relationships between the properties of an educational intervention and the characteristics of the learners - in the case of environment the learners and the learning groups - that enable particular kinds of learning by them and in the environment for the other members of the group.

Educational affordances in distributed learning groups encompass the same two relationships as social affordances. The environment must fulfill the learning intentions of the member as soon as these intentions crop up while the affordances must be meaningful and must support or anticipate the learning intentions of the group-member. Further, once a learning need becomes salient (perception), the educational affordances will not only invite but will also guide her/him to make use of a learning intervention to satisfy that need (action). The salience of the learning intervention may depend upon factors such as expectations, prior experiences, and/or focus of attention. In the next section we will discuss how these ideas can be incorporated into the design process.

Design Guidelines

According to Norman (1992), the major problem with most new technological devices and programs - and in our opinion also in their use in education - "is that they are badly conceived, developed solely with the goal of using technology. They ignore completely the human side, the needs and the abilities of people who will presumably use the devices" (p. 65). Take, for example, the escalator. This device, a moving stairway, was designed with the intention of speeding up human traffic in a stairway by increasing a person's stair climbing speed with the speed of the escalator. As we all have probably noticed – with the exception of the British – is that it has actually achieved the opposite. Large crowds tend to gather and cue at the top or bottom of the escalator because the users tend to stand still on the escalator itself. This could be the result of human nature (i.e., inherent laziness) that was not entered into the design equation, the non-ergonomic step size that we encounter on almost all escalators (as we all have noticed when we have had to climb or descend an escalator that was standing still) or a combination of the two. Good use – and that means both usability and usefulness - requires a design process grounded in user-centered design research.

We propose a Six-Stage Model for the design of environments on a general level (see Figure 1). In this model, the designer must:

1. Determine what learners actually do: Watch students interact, observe collaborating groups nteracting to solve problems, observe users interacting with software, et cetera, and do this before designing and developing.
2. Determine what can be done to support those learners: Determine, based on stage 1, what actually needs to be supported / afforded and then proceed.
3. Determine the constraints of the learner, learning situation and learning environment and the conventions that already exist: Look further than the technological constraints and conventions and take into account the educational and social constraints and conventions that play a role in collaborative environments.
4. Determine how learners perceive and experience the support provided: There is a world of difference between (good) intentions and user perceptions thereof. Research and design must be carried out as iterative, interacting processes. New 'products' must be tried out with intended users at stages in their development where physical and conceptual changes can still be made.
5. Determine how the learner actually uses the support provided: Analogous to stage 1, and following up the more formative evaluations carried out in stage 4 determine if the learner actually does what is hoped or expected.
6. Determine what has been learnt: The goal of education is learning and there are three standards to determine the success of any instructional design, namely its effectiveness, its efficiency and the satisfaction of those learning and/or teaching. An increase in one or more of the standards without a concomitant decrease in any of the others means success. This is the proof of the pudding.

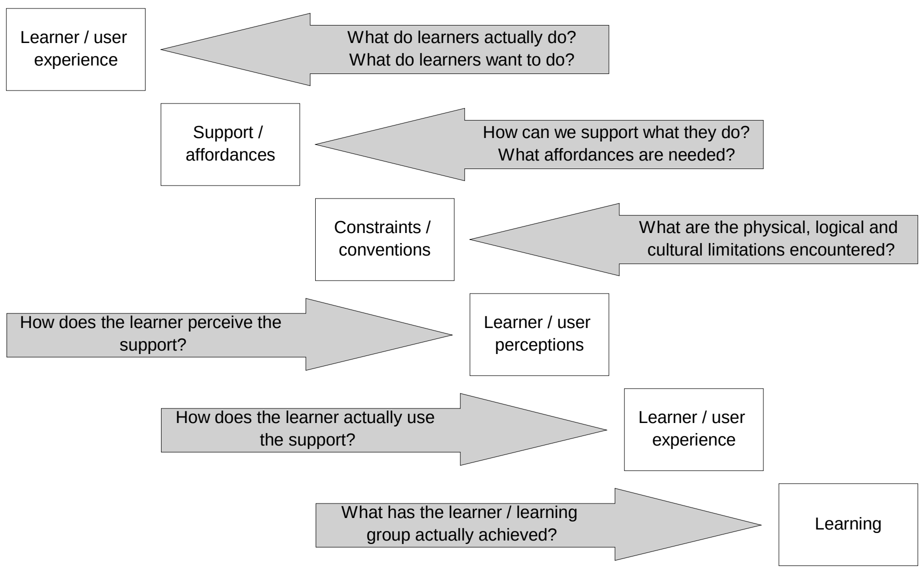

Figure 1. Six-Stage Model of Design

These six stages provide a general approach to instructional design of environments. But, this design needs to also assure that the type of social interaction regarded to be supportive for competency development actually occurs. Thus, complementary to the Six-Stage Model, a more specific, process-oriented design methodology is needed which supplies the designer with those questions which must be answered in Stage 3 of the general design level (i.e., to determine the constraints of the learner, learning situation and learning environment). Process-oriented methods may stimulate designers to adopt a probabilistic approach to CSCL design according to the expected interaction, paying attention to critical elements (constraints) affecting the interaction. Strijbos, Martens, and Jochems (in press), propose just such a methodology also consisting of six steps, namely: (1) determining the competencies to be developed, (2) determining the expected (changes in) interaction, (3) selecting the task type, (4) determining whether and how much pre-structuring support is needed, (5) determining the group size which will ensure that the type of social interaction needed for competency development develops, and (6) determining how computer support can be best applied.

Space does not allow a comprehensive operationalization of the two frameworks for the whole of the educational process and all of the actors taking part in it. As most educational design centers around the task, the operationalization of the framework here will focus on Step 3 of the specific design level, i.e. selecting the task-type. We identify three constraints that need to be considered, namely task ownership, task character and task control. We regard task ownership, task character, and task control as defining factors in the educational affording of environments, which will be illustrated through specific prototypical design questions related to these factors. In this discussion we make use of those specific questions pertaining to the third stage of the general model in that they can be used to determine the constraints of the learning environment.

Task Ownership

Ownership in a group is influenced by two pedagogical principles, namely individual accountability and positive independence. Individual accountability (Slavin, 1980) was introduced to counter the free rider or hitchhiking effect: some students would not invest any (or only a minimum of) effort into group performance. By stressing individual accountability, what the group does as a whole becomes less important. It is perfectly valid that in a group environment, each group member is individually accountable for his or her own work. For example, in many problem based learning environments students' sense of individual ownership is increased through grading them for their individual effort, irrespective of the group's performance. Positive interdependence (Johnson, 1981) reflects the level to which group members are dependent upon each other for effective group performance (enhanced intra-group interaction). Positive interdependence holds that each individual can be held individually accountable for the work of the group and the group as a whole is responsible for the learning of each of the individual group members. Essential here is social cohesion and a heightened sense of 'belonging' to a group. Positive interdependence is evident when group members in a project-centered learning environment carry out different tasks within a group project, all of which are needed in the final product. Interdependence can be stimulated through the tasks, resources, goals, rewards, roles or the environment itself (Brush, 1998).

Positive interdependence, in turn, provides the context within which promotive interaction takes place. According to Johnson and Johnson (1996), promotive interaction “exists when individuals encourage and facilitate each other's efforts to complete tasks in order to reach the group's goals.” (p. 1028). In other words, individual accountability, positive interdependence, and promotive interaction counter the tendency towards hiding and anonymity.

Task Character

Traditional school tasks are highly constructed, oriented towards the individual, and are usually well-structured, short in length, well-defined, and designed to best fit the content and not reality. An archetypical problem is: “Two trains traveling in opposite directions …” On the other side of the coin are real life (authentic) problems that are almost always ill-structured (Mitroff, Mason, & Bonoma, 1976) and/or wicked (introduced by Rittel & Weber, 1984; see also Conklin & Weil, 1997). They are often so complex and multifaceted that they can only be solved by multidisciplinary groups working together, where the group members assuage cognitive conflict, elaborate on each other’s contributions and co-construct shared representations and meaning. Examples of such wicked problems are the building a new type of automobile, the legalization of marijuana, and so further.

Complex ill-structured problems require a different educational approach than simple, well-defined ones. To educate people to be able to solve these types of problems we need to choose for a whole task approach, since, after all, real life tasks are not neat segments of some idealized whole. Whole tasks need to be divisible into, non-trivial, authentic part-tasks, which aim at achieving ‘epistemic fluency’. Morrison and Collins (1996) define ‘epistemic fluency’ as “the ability to identify and use different ways of knowing, to understand their different forms of expression and evaluation, and to take the perspective of others who are operating within a different epistemic framework” (p. 109). Ohlsson (1996) enumerates seven epistemic tasks that can be used as guiding principles for the design of collaborative environments (describing, explaining, predicting, arguing, critiquing, explicating, defining), since they indicate the ‘discourse-bound’ activities that learners will have to fulfill during collaborative learning and working.

Task Control

Task control is strongly related to "learner control" which has had a somewhat fluid and eclectic history. In its broadest sense, learner control is the degree to which a learner can direct his/her own learning experience (Shyu & Brown, 1992). More specifically, learner control is the degree to which individuals control the path, pace, and/or contingencies of instruction (Hannafin, 1984). New learning paradigms and new technologies expand this concept of control since they make it possible to provide learners with control over depth of study, range of content, number and type of delivery media, and time spent on learning. With these options, learners can tailor the learning experience to meet their specific needs and interests. For this reason, learner control is not "a unitary construct, but rather a collection of strategies that function in different ways depending upon what is being controlled by whom" (Ross & Morrison, 1989, p. 29). Indeed, learner control may be a continuum of instructional strategies in which the learner is provided with the option for controlling one or more of the parameters of the learning environment (Parsons, 1991). This control can be related to such aspects as context, content, sequencing, pacing, feedback, reinforcement and possibly even learning or presentation style. However, Reeves (1993) points out that a problem with researching learner control centers around what learner control really is, because it could be the pace of learning, as well as sequencing, content, and speed of a program; and much more.

Task control in environments relates to a number of interacting aspects of the total environment that deal with determining the relevant set of actions that students can, should or must perform as well as what an adequate, applicable or best solution or solution path is. It relates to the roles of the teacher/coach versus those of the learners with respect to selecting the relevant activities and learning approach. An underlying assumption here is that learners are amply self-sufficient to be given control over their own learning activities and collaboration methods. Table 4 provides questions relating to design decisions about task control (in terms of ‘pre-structuring’ needed) and the type of competence development that can be afforded.

Three Research Examples of Environments at the Open University of the Netherlands

Functional Roles

CSCL-environments at the Open University of the Netherlands are primarily text-based and asynchronous communication is used. Introducing this form of communication and technological tools introduces students to an unfamiliar realm. An approach to supporting such asynchronous coordination is the use of roles (Brush, 1998). Since roles promote group cohesion and responsibility (Forsyth, 1999; Mudrack & Farrell, 1995), they can be used to foster 'positive interdependence' and 'individual accountability' (task) ownership). The first research project discussed here focuses on the effect of functional roles that provide context independent process support – developed for higher education – on group interaction and specifically the effect on coordination.

With respect to technological affordances it was decided to limit the technology to the primary process being facilitated: communication. In that respect e-mail was sufficient. Since a sense of belonging to a group is essential to team formation, roles provide a social affordance for the development of group cohesion and a sense of responsibility. Finally, the roles provide an educational affordance given the assumption that they decrease coordination in favor of task-focused communication. In addition, the functional roles used are context-independent and thus transferable to other content domains in which project-centered work is conducted.

Method.

Fifty-seven students enrolled in a course on 'policy development' and twenty-three students in a course on 'local government' (49 male and 31 female). Age ranged from 23 to 67 years (Mean = 34.4, SD = 9.03). The study has a quasi-experimental random independent groups design and was conducted in a course on 'policy development'. The manipulation involved the introduction of a prescribed role-instruction in half of the groups (R-groups), aimed at promoting the coordination and organization of activities essential for the group project. The other half of the groups was completely self-reliant with respect to organization and coordination of their activities (NR-groups). Each group consisted of four students and throughout the course they communicated electronically by e-mail. Their task was to collaboratively write a policy report containing an advice regarding 'reorganization of local administration', a topical subject in the Netherlands (and a very 'wicked problem'). For a thorough discussion of the results and methodological considerations of this project see Strijbos, Martens, Jochems and Broers (submitted) and Strijbos, Martens, Jochems and Prins (in preparation).

Results.

A non-directional Mann-Whitney test revealed no significant differences between conditions with respect to the group grade ($Z = -1.549$, $df = 4$, $p > .05$). Several scales in the self-report questionnaires comprised a single latent variable that was interpreted as 'perceived group efficiency' (PGE). An F-test for homogeneity of variances to investigate the hypothesis of equality of variances in both conditions for the model without random slope ($F = 2.86$, $df = 4$, $p > .10$) and the model with random slope ($F = 5.86$, $df = 4$, $.05 < p < .10$) revealed a tendency with respect to students' awareness of group efficiency. The outcome of the content analysis corroborates this interpretation.

A non-directional Mann-Whitney test revealed a significant difference with respect to 'task social' statements ($Z = 2.121$, $df = 4$, $p < .05$). Students in the role condition contributed more statements that expressed, either a positive or negative, evaluation or attitude in general, towards the group or towards an individual group member. Furthermore, more 'task content' statements were observed in the role condition ($Z = 1.984$, $df = 4$, $p < .05$). However, the assumption that this would be due a decrease in the amount of coordinative statements was not confirmed. In fact, a directional test revealed that the amount of coordinative statements in the role groups also increased ($Z = 1.776$, $df = 4$, $p < .05$; one-sided). Apparently, functional roles stimulated coordination and as a result 'task content' statements increased as well ($r = .73$, $p < .01$).

A comparison between both conditions of dropout during the course ('quit' category) reveals no differences. However, a comparison of the total number of students that did not finish the course ('quit' and 'no credits') shows a significant difference with respect to the distribution ($\chi^2 = 6{,}118$, $df = 1$, $p < .05$). Eighteen students in the 'non role' condition - compared to eight students in the 'role' condition - failed to finish the course in time.

Conclusion.

The outcomes of this study clearly reveal that focusing solely on group performance outcomes (i.e., grades) as indications of successful collaboration is insubstantial evidence. As well as their design, the study of the environment requires triangulation of research methods and different types of data to construct a representation of the collaborative process.

Group Awareness Widgets

The aim of the second research presented here is to create sociable environments that meet as much of the social (psychological) needs of learners through the explicit embedding of social functionality in them using the framework of social affordances. Within the area of human computer interaction and computer-supported collaborative work, researchers have already become aware that such sociable environments are needed by virtual groups (Donath, 1997; Feenberg, 1989). Bly, Harrison, and Irwin (1993) argue, “The smooth integration of casual and task-specific interactions, combined with the ability to meet informally as well as formally, is a critical aspect of productive group work” (p. 29). In contrast, they observe that “Most tools in computer-supported cooperative work (CSCW) are devoted to the computational support of task-specific activities, but support for cooperative work is not complete without considering all aspects of the work group process. When groups are geographically distributed, it is particularly important not to neglect the need for informal interactions, spontaneous conversations, and even general awareness of people and events at other sites” (p. 29). The kind of social affordances we wish to implement focus on stimulation of informal and casual conversations, stimulation of impromptu encounters, and bridging the ‘time gap’ imposed by asynchronicity. All three aims imply proximity to be an important dimension of social affordances. The first two aims address proximity of place (i.e., spatial proximity) and the latter addresses proximity of time (i.e., temporal proximity) that can be bridged by using ‘traces’ which introduce a form of history awareness (Kreijns, Kirschner, & Jochems, 2003).

In CSCL-environments, social affordances devices may be operationalized by group awareness widgets (GAWs). These widgets are software tools providing group awareness to provide virtual spatial proximity, history awareness, (i.e. the structured collection of all traces) to provide an overview of temporal proximities, and a set of communication media for perception-action coupling.

Based upon the social affordances framework, we have implemented a first prototype of a GAW. This prototype is a first step, not all the implications of the framework are implemented; the set of communication media contains the traditional communication media (chat and e-mail) and pictures of the participants are used.

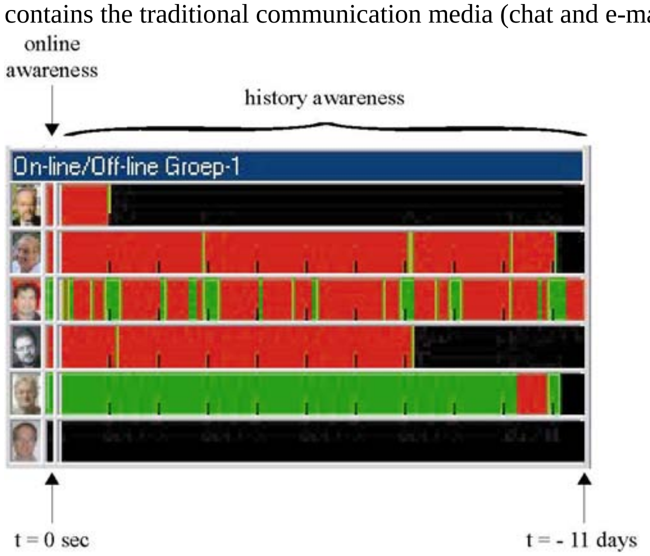

Figure 2. The prototype Group Awareness Widget

The window has a time-axis along which strokes are displayed. The stroke length is an indication of the duration of the engagement. Each member is displayed with her or his strokes. Green (i.e., dark grey if printed) means on-line, red (i.e., also dark grey if printed, but a bit lighter as green) means off-line. Black means that there is no history data available for displaying. As can be seen from figure 2, history awareness is limited to 11 day’s; days a separated from each other by small vertical black strokes. Clicking on the portrait of a group member or on a stroke opens a dialog box from which the communication channels are accessible. The dialog box also contains personal and business information about that group member.

As simple as this single segment of the GAW is, it may already invite the group learner to initiate a communication episode that is not based on the learning tasks to be done. It provides the group member with information that may stimulate social interaction with others in the following ways: A group member may perceive that (s)he is not alone in the environment, even in the case that there are no group members currently online; group members may show up at regular times providing opportunities for future contacts in real-time; Patterns of 'busy times' become visible; A real-time conversation can be initiated with group members currently online (i.e., a chance encounter), or a message can be sent to a group member who is currently not online.

In addition to the framework of social affordances, the second research also encompasses the concepts of sociability and social presence that have a relationship with the concept of social affordances. To this end, instruments are developed that measure the degree of sociability, social space, and social presence (Kreijns, Kirschner, Jochems, & van Buuren, 2003). Testing the hypotheses is the current focus of this research.

A Formalism to Support Common Ground

The third study discussed here aims at facilitating grounding in such environments (see Beers, Boshuizen, & Kirschner, 2003 for a more detailed description of this study). The main aim of our research is the design of social/technological affordance that invites and allows users to negotiate meaning while collaborating in context of solving wicked problems. This specific experiment was carried out to explore whether a negotiation widget or tool would positively affect the process of negotiating common ground.

The process of negotiation starts when a team member makes her/his own, as yet unshared knowledge explicit or tangible to others. This can be oral, written, symbolic, et cetera. After one team member has made a contribution, others can try to understand it. In doing this they can consider aspects of the contributor (e.g., educational background, political views, et cetera) as well as their own beliefs and assumptions. A contribution is thus understood against the presumed perspective of the other, as well as against one's own perspective (Bromme, 2000). According to Clark and Shaefer (1989), the process of grounding continues until "the contributor and the partners mutually believe that the partners have understood what the contributor meant to a criterion sufficient for the current purpose" (p. 262).

This exploration served as the basis for the design of educational affordances. CSCL environments often make use of external representations formed/restricted by a formalism: a set of objects and rules for making an external representation. In this research a formalism for facilitating negotiation of common ground in problem-solving groups was developed and tested. We expect the formalism to result in more negotiation activities and, ultimately, more common ground. The formalism was embedded in the newsgroup environment by adding specific message types, and specific rules about when one was allowed to post messages of certain types.

Method.

In a pilot study we studied people collaborating in a face-to-face setting who were required to making use of a pen-and-paper approximation of the negotiation formalism during their work. Participants were to solve a complex economics problem derived from a dynamic economics simulation game. First, the participants were allowed to practice with the simulation individually, and to solve the case individually, so that they were able to fully apply their own perspective to the task. Next, they solved the problem collaboratively, and after that individually again. All individual problem representations and solutions, as well as the group problem representation and solution, were gathered. The collaboration process was also videotaped.

Procedure.

Groups using the formalism were compared with groups not using the formalism. The formalism was built into a widget for a discussion list. A coding scheme for analysis of the collaboration process was developed in which different categories were used for new conversation topics (Contribution), verifying one's own understanding of another's utterance (Verification), clarifying the intended meaning of a previous utterance (Clarification), e.g. as a reaction to a verification, and Elaboration when talk continues about a certain topic, without verifying and clarifying intended meaning of utterances. A high number of clarifications and verifications was seen as indicative for explicit negotiation processes. To get an indication of common ground, overlap between individual problem representations after problem solving was determined. To do this, discussion topics were identified in the coding process to characterise the content of individual representations. Each topic was investigated with respect to whether an individual representation it was present after collaboration. The extent to which specific topics from the discussions were present in more individual representations after collaboration was seen as an indication for common ground.

Results.

A preliminary analysis of the data is presented in Table 1. With regard to negotiation, results indicated that the formalism-groups spent more time on negotiation processes than the non-formalism groups (i.e., groups that used their own idiosyncratic representation method), as reflected by the number of utterances that were representative of negotiation. Furthermore, the formalism groups discussed more different topics than the idiosyncratic groups. Third, more members of the formalism groups participated in discussion (Participants per segment) than in the idiosyncratic groups. These results suggest a more equal representation of different perspectives in the collaboration process than in the idiosyncratic group. We conclude that the formalism seems to be able to affect negotiation processes by making them more explicit.

	Mean		Standard deviation	
	Formalism	No formalism	Formalism	No formalism
Time (s)	3182	2341	390.58	579.66
Contribution	25.00	19.30	4.36	4.51
Verification	38.00	19.30	5.20	8.50
Clarification	46.00	26.70	7.21	6.66
Elaboration	118.00	102.00	34.51	17.44
Negotiation[a] per contribution	3.37	2.38	.09	.58
Participants per segment	2.67	2.47	.09	.07

[a] Negotiation = negotiation of meaning = sum of verifications and clarifications.

Table 1. *Differences in use of categories*

With regard to common ground, our results indicated that the formalism groups achieved more common ground than the idiosyncratic group (see Table 2). As mentioned, the formalism groups discussed more different topics, and captured more of these topics in their group external representation. Furthermore, members of the formalism groups mentioned more different discussion topics in their individual problem representations after the problem solving task, and there appeared to be more agreement between them than between the participants of the idiosyncratic groups (i.e., their individual representations resembled each other more closely than the individual representation made by the members of the idiosyncratic group). We conclude that the formalism indeed seems to have positively influenced the extent to which common ground has been negotiated.

	Mean		Standard deviation	
	Formalism	No formalism	Formalism	No formalism
Total number discussion topics...	25.0	19.3	4.36	4.51
...in the group external representation	19.3	12.0	9.50	5.56
...in the group solution	8.7	2.3	2.52	1.15
...in one individual representation	6.3	6.3	3.06	2.08
...in two individual representations	4.0	2.0	3.00	1.00
...in three individual representations	3.3	2.3	3.08	2.31

Table 2. *Common ground*

These results have to be regarded with some caution. Only six groups were tested, and no statistical tests were used due to our small sample size. The results do provide encouragement to further develop the tool for facilitating the grounding process.

Conclusions

We have outlined a theoretical framework for the design of environments and illustrated this with examples from three research projects. The concept of affordances is central to this design and specifically in those cases where the learning environment centers on collaboration. With respect to the design of iecles it is not of primary importance what exactly is caused by different elements of the learning environment (learning is no longer causal or deterministic, but has become probabilistic). More important is whether the elements of a learning environment afford the type of competency development that was targeted. With respect to collaboration, the question is whether the elements of the environment afford the emergence of that type of social interaction that is supportive for the acquisition of the targeted skill.

But these questions cannot be easily answered. We, as designers often think that we know what our designs and products will do and how those, for whom our designs and products are intended, will use them. Unfortunately, this is not always the case. Each of the phases in the design process needs to be studied with respect to the specific choices that can and must be made. Some research is fundamental such as research to determine how iecle interface design or the way information is presented (e.g., Kester, Kirschner, & van Merriënboer, 2002) affects cognitive load and learning. Other research is more developmental in nature such as research on how group awareness widgets (Kreijns & Kirschner, 2002) affect the perception of sociability, social space and social presence. And still other research is applied such as how specific learners or learner groups perceive a specific iecle.

Design of CSCL-environments needs to be carried out at two levels, namely a generic and specific level. The impacts of both levels have been illustrated with respect to task ownership, task character and task control. Clearly, the design of a CSCL-environment requires that both levels be taken into account with the specific level being a detailed depiction of the third stage of the general model in that it is used to determine the constraints of the learning environment. Although teachers and designers may prefer a clear set of design rules (i.e., first do A, then do B if you want to achieve C), a deterministic checklist with a limited number of categories is one step too far. We have, however, provided a number of specific design questions to stimulate teachers and designers to think more deeply about their instructional decisions, and not to simply rely on their traditional approach that "has worked so well".

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Use of Internet among Faculty Members of Anadolu University in Turkey

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Abstract

Advances in information technologies have provided tremendous opportunities for professionals in almost all fields. For many, especially Internet along with its capability of providing easy and faster communications, access to resources, etc., has opened a new are in the history of world.

Academicians are among those professionals who get benefits of Internet in their daily tasks. For instance, a faculty member who wants to conduct a research on any subject can reach so many up-to-date resources on the subject by couple of keystrokes and clicks. Once, before the spread of Internet use, accessing the up-to-date research finding was a big hassle. Faculty members use Internet not only for research purposes but also for instruction, publication, and communication.

For the members of the universities in developing countries where they as well as other citizens of the country struggle with economic problems, Internet has become something inevitable. Now a faculty member by using Internet can discuss any topic with her/his colleagues all over the world, can publish results of her/his studies, conduct a research on information databases, and even offer a course to her/his distance students. The Internet and its ancestors (EARN - European Academic Research Network) have been available to Turkish academicians since the late 1980s. During the early days only a few people were able to use and access to these facilities. However, since the late 1990's the number of the Turkish academicians who are using Internet everyday has burst.

However, since there is no formal faculty development plans in Turkish universities and the rate of computer ownership at homes is around 3% among all the citizens of Turkey, questions such as "Do the Turkish academicians use Internet?", "How do they, especially older ones, learn to use Internet?", "What do they think of Internet?" are subject to curiosity. But, no study has been conducted to investigate patterns of Internet usage among Turkish academicians.

The main purpose of this study is to investigate the patterns of Internet usage among faculty members of a university. In the study, it has been tried to answer following questions:

(1) What is the frequency of academicians' Internet usage?
(2) How did they learn to use the Internet?
(3) How often and for what purposes do they use Internet for?
(4) Are they satisfied using the World Wide Web for research?
(5) What is the self-efficacy level of academician's for Internet?

Method

The design of the study was based upon the general survey method. The data were gathered through a 49 items questionnaire. The first part of the questionnaire consisted of the questions related to demographic characteristics of the faculty members such as age, gender, academic titles, and departments in which they work. These data were used to compare if the Internet usage differ according to gender, age groups, academic titles, disciplines.

The second part of the questionnaire involves questions about accessing a computer and Internet, frequency of using Internet, ways of learning to use Internet, frequency of using varying Internet tools (such as e-mail, newsgroups, WWW), purposes of using Internet, effective use of Internet tools and search engines.

In addition two scales have been located at the last part of the questionnaire. The first one is a translation of the End User Computing Satisfaction Instrument (EUCS). The EUCS was developed by William J. Doll and Gholamreza Torkzadeh to test the user satisfaction from the Internet resources. This scale includes 15 questions to measure five factors; content, accuracy, ease of use, format, and timeliness. Each item was answered on a Likert-type scale of 1 (almost never) to 5 (almost always). The mean for each question was assumed to be 3 (sometimes).

The second scale is a part of the Online Technologies Self-efficacy Scale developed by Marios Miltiadou. The original scale consisted of 30 items. First 10 items of this scale are related to the self-efficacy of the users for general Internet competencies. These 10 items were included into the questionnaire. In this scale each question was answered 1 (not confident at all) to 4 (very confident).

Descriptive statistics, variance analysis and t-test were used to analyze the data gathered through the questionnaire.

Results and Discussion

The questionnaire was administered to the faculty members working in different colleges and departments of Anadolu University, Turkey. At the end of a stratified random sampling, 295 academicians were selected out of 982. Paper and pencil type of the questionnaires were distributed all sampling and allowed one month to send back. The 248 (%84) academicians filled out the questionnaire. Academic departments of respondent are shown in Table 1.

Table 1 *Academic Department of Respondents*

Departments	N	%
Faculty of Education	44	18
Faculty of Engineering and Architecture	38	15
Faculty of Open Education	36	15
Science Faculty	35	14
Faculty of Communication Science	19	8
Faculty of Literature	19	8
Faculty of Pharmacy	19	8
Faculty of Fine Arts	18	7
Faculty of Economic and Administrative Science	11	4
Faculty of Law	9	4
Total	**248**	**100**

Respondents were asked to select from five categories of faculty rank: research assistant, instructor, assistant professor, associate professor, and professor. 69 (28%) respondents were research assistant, 70 (28%) instructor, 62 (25%) assistant professor, 32 (13%) associate professor, 15 (6%) professor.

Results have shown that Internet is used every day by the majority of faculty members and the majority of them have used internet over three years. Many of them (86%) learned to use Internet through independent learning method (trial and error). Among the Internet tools, e-mail (M=4.73) and World Wide Web (M=3.79) are the ones most frequently used by academicians. Respectfully other results are electronic journals; document delivery services; external catalogs and bibliographies; discussion lists and news groups; and software download.

Each part of the questionnaire, t-test and one way ANOVA was run to determine if significant differences existed among the independent variables of gender, age, academic titles, and disciplines. Significant differences were found for the discipline factor in terms of e-mail (p=.037), electronic journals (p=.001), and document delivery services (p=.001). In all cases means for science were higher than means for social science.
Significant differences were found for the age factor regarding to e-mail (p=.040; M=4.73; sd=.66), discussion list and news group (p=.048; M=2.83; sd=1.19). In other cases weren't found any significant differences.

Academicians use the Internet and WWW every day for research purpose (M=4.55). Respectively the other mean scores are communication (M=3.83), teaching (M=3.05), and publication (M=2.59). According to these results academicians often use Internet and WWW for communication purpose, sometimes for teaching purpose, and uncommonly for publication purpose. Significant differences were found for the age factor and the gender factor in terms of research purpose.

The study also revealed that the faculty members are trust themselves about using the Internet, because each item mean scores are higher than critical level (M_{cl} = 2.51). Also faculty member are self-confident about the use information retrieval resources.

They use search engines every time (M=4.39) for finding information and often use subject directories (M=3.75), data bases (3.73), and electronic journals (M=3.72). On the other hand, although faculty members mostly use search engine to retrieve electronic information, generally they don't use search operator that simplify to retrieve electronic information.

In addition, each respondent was asked to complete the EUCS survey by indicating how often they would respond to each of 15 question on a scale (from 1=almost never to 5=almost always). These questions were grouped into six factor section, and the sum of the responses in each section determined individual factor scores. The factor scores were totaled for overall scores. Assuming an expected mean of 3 (sometimes) for each question, the means returned were significantly higher than the expected means.

T test were run for all individual question scores, factor scores, and overall scores, using the expected means as the comparison. All scores showed a significant differences at $p = .05$.

One way ANOVA was run to determine whether any significant differences existed among the independent variables of gender, age, academic titles, and disciplines.

Significant differences were found for the academic titles factor in terms of content (p=.014), accuracy (p=.005), timeliness (p= .019) factors and overall EUCS (p= .014) scores. Also significant differences were found for the gender factor in terms of accuracy (p= .045). These finding shows that academicians question the content and the accuracy of most of the web-based information.

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Web-Enhancing a Traditional Class: Lessons Learned and Lessons That Need to Be Learned

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Rationale

Business Administration students need to acquire skills that will enable them to produce effective written business communication. Effective English communication is an asset for graduates since the majority of employment opportunities aim at bilingual candidates in Puerto Rico.

In today's world, these students also need to enhance their computer and technology skills. The usage of the Internet and technology in Business is a reality and it is here to stay. This paper intends to share the different activities that can be used to practice and enhance English and technological computer skills. Some results will be shared.

Before going on-line: A study of the Needs of Corporate World and the Students

The research place had carried out a needs assessment in the year 2001. Corporations and student focus groups were interviewed. Some results follow.

Corporate World

Nine corporations were interviewed. These corporations represented the following areas: tourism/hospitality, health services, technology, business administration, technology, and education.
In every case, the corporate responses to the needs were that they wanted Hispanic graduates who have truly comprehensive bilingual skills. Being Bilingual and being able to use technology were valued skills and was seen as a real contribution to the workforce. All interviewees pointed out that English language deficiencies – particularly bilingual deficiencies in areas of professional training -- were holding back the advancement of many Hispanics in their organizations

The students' perspective

A focus group was carried out. The subjects of the focus group were divided into four groups of 7-10 participants each, in the 18-49 age group, male and female presumably, who have attempted at least 24 college credits but did not earn a college degree.

The goals of the study were to determine potential students' educational desires, and which elements of the proposed web-enhanced course are found favorable and which are not. Subjects stated what they wanted was: Language support in terms of bilingual instructors.

1. An exciting, innovative, dynamic approach, with small groups
2. Job relevance in terms of instructors who have been in the field and curriculum that is applicable to the job.
3. Internet, online capabilities. Comments included having access to information online, hosted by the school, or if the school had online workstations that the student could use.

   For some participants the lack of English competence had prevented them from succeeding academically in past attempts.

As to why they wanted to pursue a degree, some of the people in the focus group had the experience that they had to prove that they were capable of doing a job. This may have to do with overcoming prejudiced attitudes, but it may have to do with their command of English, either in correctness or proper business use.

Now as the teacher that read this report, I needed to ask myself several questions before going on-line and starting to plan on web-enhancing my courses. Some of the questions were:

1. How many students have computers or computer access?
2. How much do students know about navigating the web?
3. Do you trust your students? How do you know if students are really doing the work and not some expert?
4. How well prepared is the university to offer students the support they need?

5. How well prepared is the university to offer you the support you need?Are you ready to be a 24/7 teacher? (Literally)

Lessons Learned

1. Communication cannot be overstressed! Having clear expectations, course requirements and providing clear direction is important for the success of the group and the class. This includes a clear idea of coursework, technical requirements and skills. It also has to include clear evaluation standards.
2. Posting Course Documents. Be clear when preparing the organizational structure. Be creative when preparing main course content. Attach documents, handouts, images and media in a timely fashion. Customize course structure with clear delimited folders.
3. When posting course-related assignments, be sure to include clear evaluation criteria, due dates, and clear instructions.
4. What can we do with Quiz results? When we met face-to-face, we would center interaction on these results. We would work in smaller groups with students who show similar difficulties. It was easier to individualize instruction. It also meant that I needed to analyze quiz results and make sure I planned appropriately.
5. Use all available tools for communication. (Discussion board, E-mail, Student Roster, Student Pages, Group Pages, Chat)
6. Providing external links for students was a great way to add online resources to a course. These links provided students with access to global resources.
7. Provide a place where students can check their grades, drop off their work, and edit their information and student page.
8. To convince stakeholders, administrators and myself, keeping track of statistical information about course usage, such as the frequency that students visit course components was necessary. When an instructor can see which pages and links are being used and track peak and off-peak access times it tells them about their students and if the materials developed are being accessed.

Advantages and Disadvantages

Advantages	Disadvantages
Students are not afraid to participate.	More time must be dedicated (teacher)
Students have time to process data	Feedback is not immediate
Self-paced	Can become too technical.
Students dedicate more time to course	Technical problems and difficulties could hinder process.
Individual attention	
Students develop technological skills	
Student centered	

My own learning

I definitely acquired many new technical skills as I started looking for different technologies I wanted to incorporate in my course. I practiced my patience. Many times dealing with different assignments from different people at different times. Answering some of the questions more than once and dealing with deadlines was challenging. I learned that flexibility was ok, as long as it didn't become a habit. I had to revisit the teaching strategies that I used in a face-to-face environment and adapt them to on-line learning. Definitely it also re-affirmed that students like to interact among themselves and learn from each other. I most importantly there was NO SIGNIFICANT DIFFERENCE between students learning at a distance and students learning in a brick and mortar classroom. The future holds many promises, and I believe that on-line learning will not totally substitute face-to-face learning, but that teaching and learning will be enriched as new and diverse technologies emerge and old technologies enhanced.

Visualizing Knowledge: Designing Information Graphics for Instruction

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Abstract

Illustrations, graphs, charts, diagrams, photos and other visual images are common components of technical, creative, and educational communications to convey conceptual, statistical, procedural, qualitative, quantitative, static and dynamic information. But how do we determine the optimal standards and attributes for effectively designing and using graphics for visualizing knowledge in particular situations? This paper describes the grounding principles of information design for instruction and the continuing development of prescriptive visual taxonomies for learning, training and development.

“Graphics is the visual means of resolving logical problems.”
J. Bertin (1981, p. 16).

This paper discusses descriptive concepts and prescriptive principles of visual perception and learner cognition that are emerging in the design and development of effective instructional course materials. Suggested strategies for the successful integration of high-quality instructional media within effective pedagogical frameworks for student course implementation activities is also briefly discussed.

Effectively illustrated courseware is systematically developed using a synthesis of (a) information design, (b) media design, and (c) interactivity design subsumed within a unifying foundation of (d) the first principles of instructional design. This will require the insightful fusion of this synergetic tetrad enabling learners to construct new knowledge through hands-on, learn-by-doing experiences. Using integrated, interactive goal-based scenarios, a student might follow open-structured, collaborative role-playing investigating problems and cause-effect relationships. Effectively designed data representations and interpersonal transactions (including text, streamed audio, static and animated graphs, charts, technical illustrations and digital images; photographic and streamed motion video, student-teacher interaction, self-assessment problems, Internet hyperlinks, listservs, threaded peer-to-peer discussion boards, database-augmented hybrid DVDs) will complement these intrinsically-motivating learner activities.

One of the central problems and corresponding challenges facing the multidisciplinary fields of educational communications and instructional technology has been in the construction of effective taxonomies for visual communication (Horn, 1998; Tufte, 1997; Ware, 2000). Numerous research studies and encyclopedic volumes have contributed to our evolving understanding of the core principles underlying sound methods and strategies for appropriately representing data information in particular contexts (Card, Mackinlay, & Shneiderman, 1999; Fleming, 1987; Harris, 1996; Wildbur & Burke,1998). The compelling task of creating comprehensive conceptual models of complex phenomena that are parsimonious and robust without being overly reductionist—and concise and cogent without being over-simplifications—continues to be formidable. A re-examination of the fundamental issues in designing epitomes of visual communication might positively contribute to this collaborative endeavor.

Graphic Theory: Envisioning the Problem Space

An explicit orienting task which requires the learner to represent a problem situation graphically can act as a cognitive strategy activator appropriate to many content domains (Derry, 1985; Fleming, 1987; Rigney, 1978). The mnemonic technique of using visual imagery in the form of graphic illustrations has been shown to assist learners in associating coordinate concepts within a logical framework and thus significantly improve concept attainment (Dwyer, 1978). Also, many of the critical heuristic methods for perceiving, representing, analyzing and ultimately solving a problem can be augmented by the drawing of a graph or diagram (Polya, 1957). A well-constructed graph, illustration or diagram can clearly and unambiguously represent all of the important concept relationships in a set of data or in a problem situation. Moreover, Bertin (1981) emphasized that:
“In considering hypotheses and methods, it is necessary to envisage the whole problem. The matrix analysis of a problem is a process which enables us to see the whole, that is, to construct it graphically, and to "foresee" the possible choices and their repercussions. “(p.17).

Therefore, the use of graphing as both a heuristic method and as a conscious cognitive strategy could enhance the problem solving repertoire of learners and contribute to their ability to (a) systematically observe, decompose and define the problem in an X-Y matrix system; and (b) process, interpret and verify the hypothesized relationships between the data (Mayer, 1983; Nickerson, Perkins, & Smith, 1985).

Problem-Based Visualization for Learning

Problem-oriented techniques have been defined by many labels from inductive to discovery. Ausubel, well-known for his coinage of the "advance organizer" concept, interpreted the problem/rule duality to be comprised of discovery versus reception processes. For Ausubel (1963), *receptive learning* consisted of presenting to the student the entire, completely defined content of what is to be learned in final form. Discovery was a more omnibus category that included problem-solving and inductive reasoning. Collectively, these approaches entail an underlying holistic pedagogy of inquiry, guided discovery, and reflective thinking. Moreover, problem-oriented techniques, such as simulations, can use the advanced technical capability of computer technology to apply the cognitive theories of generative learning and individualized, intrinsically motivating instruction (Keller, 1983; Wittrock, 1974, 1978). Unfortunately even to this day, much of what constitutes secondary and college-level instruction continues to be predominantly receptive learning approaches that disembody information into predigested abstract chunks that are easy to deliver but provide little scaffolding for meaningful learning (Mayer, 1989, 1999). This trend is also observed in the promulgation of factoids and blather lines in commercial mass communication and collaterally by the poor design and use of sound visualization techniques in schools.

The Roots of the New Paradigm in Instruction

Constructivist theory and practice have now earnestly captured the imagination of the academic world (Reigeluth, 1999). The dominant intellectual scaffold for the emergence of constructivist theory was clearly the cognitive movement in instruction. Cognitive approaches (which emerged during the late 1960s and matured into the 1970s and 1980s) are concerned with the active, generative construction of meaningful knowledge in the mind of the learner. Serious future research into any aspect of the dynamic instruction and learning process must maintain an awareness that instruction is mediated by student thought processes. The literature on cognitive models has long posited that the fundamental characteristic of the mind as a cognitive system is adaptability: the long-term ability to modify existing internal conceptual schemata to absorb new information (Eysenck, 1984; Glaser, 1977; Wang, 1980; Wittrock, 1978). Learners construct meaning as they approach new content domains and problem-solving tasks through active processes of inquiry, exploration, and hypothesis-generation and testing (Taba, Durkin, Fraenkel, & McNaughton, 1971; Wittrock, 1974). Thinking critically and formulating generalizations and principles through the manipulation and observation of data is a concept formation activity which places the major responsibility for learning on the student (Taba, et al., 1971; White, 1969). Generally, these studies emphasize that thinking involves an active transaction between an individual and the data which he or she is studying. Data becomes meaningful only when an individual performs certain cognitive operations upon such data. Moreover, all students are viewed as potentially capable of thinking at abstract, analytical levels under the appropriate conditions of learning, and instructional strategies can be designed which will improve the higher-order thinking skills of individual learners (diSessa, 1977; Kirby, 1984; Nickerson, et al., 1985; Perkins, 1986; Shuell, 1986; Wittrock, 1978, 1974).

Cognitive strategies have been prominent in the development of instructional design and learning theory (Briggs, 1977; Dansereau, 1978; Gagne & Briggs, 1974; Grippin & Peters, 1984; Rigney, 1978). Appropriate cognitive strategies can facilitate the learner in "learning how to learn, how to remember, how to carry out the reflective and analytic thought that leads to more learning." (Gagne, 1977, p. 167). Moreover, learning a model of the underlying reasoning process used to generate solutions to problems within a domain is an important aspect of formalizing knowledge and in fostering skills in concept acquisition (Polya, 1957). A strategy utilizing such a model can become a conscious "metastrategy" used by learners as a powerful tool in their approach to understanding novel problem situations and concepts within the content domain (Allen & Merrill, 1985; Derry, 1985; Mayer, 1989).

The terms "concept" and "principle" have often been used broadly and interchangeably. Reigeluth (1983) distinguishes between concepts, which are predefined categorizations of phenomena, and principles, which are observed as relationships of change. These changes may simply be correlational, where two or more elements change simultaneously, or they may be causal, where a change in one element causes a corresponding change in another. While a concept consists of "a set of objects, events, or symbols that have certain characteristics in common," principles describe "the relationship between a change in one thing and a change in something else." (p.343).

More recently Eisner (1998)—a strong proponent of visual literacy and arts education in the schools— has advocated the value of expanding our design and implementation of curricula that emphasize visualization skills for expression, communication, and learning generally. He has posited a set of underlying premises that support the case for cognitive and social constructivism including the observations that (a): the form of representation influences both the processes and products of thinking; (b) different forms of representation develop different cognitive skills and forms of thinking; (c) the selection of a representation form influences not only what can be represented, but also what can be envisioned; (d) each form of representation can be used in different ways; and (e) different forms of representation can be combined to enrich the array of resources students can respond to.

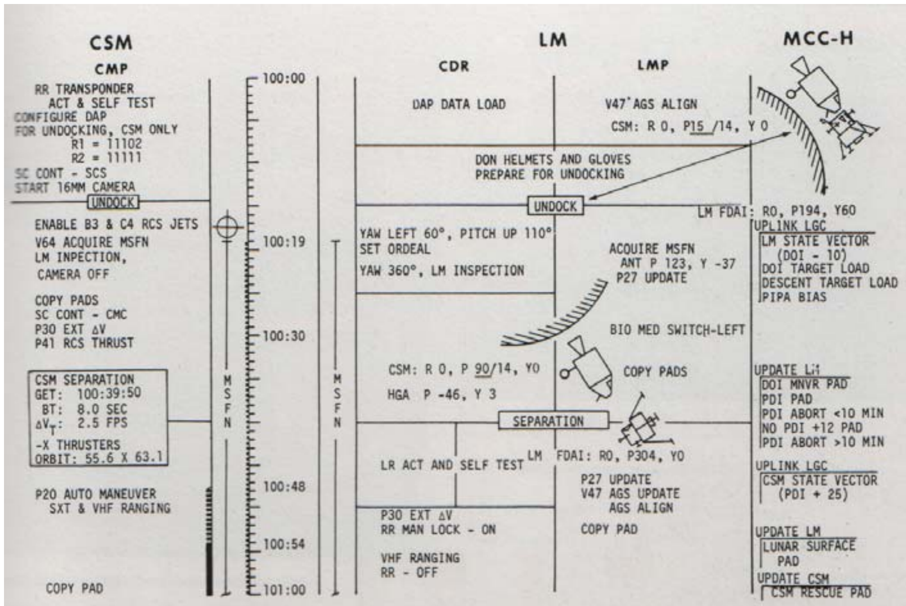

Figure 1. Apollo 11 Lunar Mission Single Hour Timeline Flight Plan for July 1969 (Source: Historic mission data from public domain Website at http://www.NASA.gov)

Building a Better Visual Metaphor

The question of identifying the most efficient forms of graphic representation for instruction demands we go deeper into fundamental questions of what educational technology and active learning is really all about. The focus should be toward fully exploiting the uniqueness, accessibility, controllability, interoperability and extensibility of diverse media (Brown & Chignell, 1995; Kristof & Satran, 1995). Importantly, we must critically examine underlying assumptions of what teaching and learning must become to actualize human potential. The really difficult task is reconceptualizing the technology "to build a better metaphor"—one which emphasizes the experiential, active construction of cognitive strategies and robust mental models (i.e., metamodels) in the learner (Mayer, 1999).

Parsimonious Graphic Design for Instruction

Intuitively, good design aesthetics should adhere to minimalist information design guidelines and (a) reduce cognitive and perceptual load by minimizing superfluous cosmetic elements when designing image and screen "real estate" while (b) maximizing the value of data content using clear, cogent text, graphical representations distilled and re-edited for high signal to noise ratios, and complementary, reinforcing and non-gratuitous media design (Carroll, 1998; Doumont, 2003a & 2003b; Hansen, 1999; Lowe, 1993; Tufte, 1990). Tufte (1997) has identified this "less is more" characteristic as the *smallest effective difference*. Figure 2 shows a clean example of an instructional graph applying the principle of parsimony.

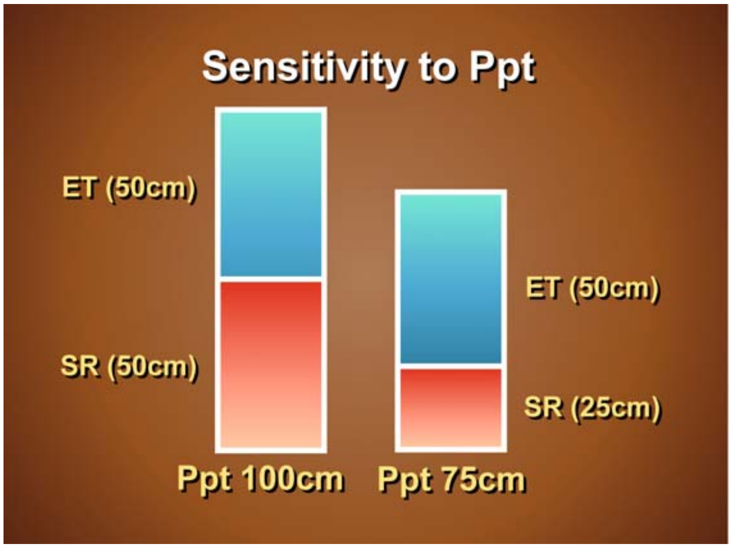

Figure 2. Sensitivity to Precipitation Bar Graph (Source: Pat Grimaldi, 2D/3D Illustrator)

Mijksenaar (1997) has synthesized a simple taxonomy to consider when designing communication graphics that is structured around three organizing categories of visual function:

Table 1. *A Basic Graphical Variable Organizing Scheme (Mijksenaar, 1997)*

Functional Categories	Visual Elements
Distinguishing classifies according to category & kind	color illustrations column width typeface
Hierarchical classifies according to importance	sequential position (chronology) position on page/screen type size line & bar spacing
Supporting accentuating & emphasizing	areas of color & shading lines & boxes (e.g. stroke) symbols, logos, icons text attributes (e.g., bold)

Adding Layers of Visual Learning Value Using New Media

Well-designed learner-centered secondary science courseware would require students to learn concepts and change relationships empirically by manipulating 2D and 3D objects and visually-represented variables within a plethora of temporal, spatial, and parametric simulations and multivariate procedural models and animations fostering scientific visualization (Fraser, 2001). After complete operational prototypes of comprehensive graphics have been produced, augment and enhance collateral and concurrent course instructional media (resources permitting). For example, if feasible add knowledge objects such as manipulable 2D and 3D static graphics and dynamic animations, interactive multidimensional and cross-disciplinary timelines (with synchronous database cross-references between domains), immersive goal-based simulations to illustrate concepts, principles, change relationships, tradeoffs, decision-making operationally, interactively and experientially (See Figure 3).

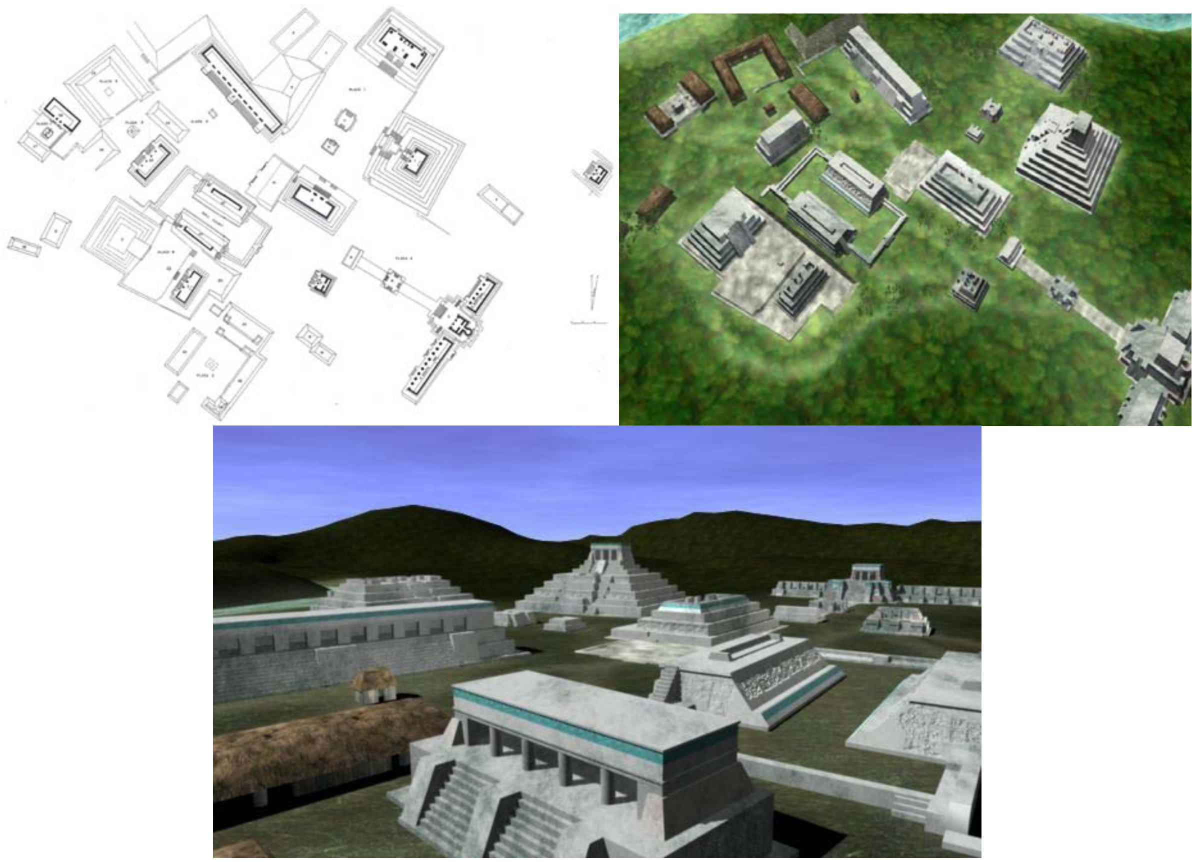

Figure 3. Mayan City Reconstruction in both 2-D and 3-D Representations (Source: Pat Grimaldi, 3D Illustrator)

The Pedagogical Power of Interactive Graphics

These objects should ostensibly be as learner-controlled as feasible. Visual displays should also be made more learner-accessible by producing indexed galleries with thumbnail images organized by topic/concept. In addition, juxtaposed simultaneous comparisons of the same image data or a close variant can provide a visual synergy that affords learners the opportunity to develop layers of understanding about the same phenomenon as shown in Figures 3, 4 and 6 (See also “multiples” and “confections” as described in Tufte, 1990).

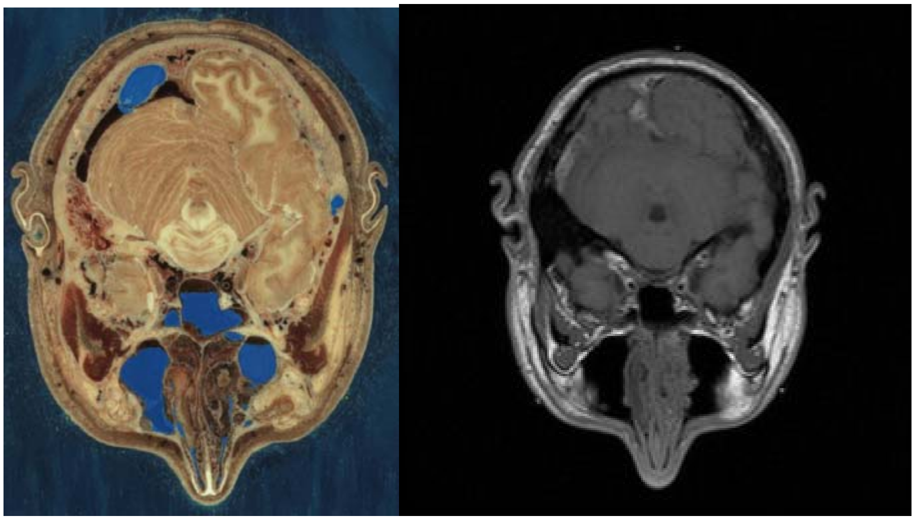

Figure 4. Comparison of Cranial Structures (Sources: left: Visible Human Project; right: MRI database. Both images downloaded from the U.S. National Library of Medicine's public domain Website at http://www.nlm.nih.gov).

Use of Visually-Engaging Simulations for Learning

The pedagogical strategy of visually-based simulation (See Figure 5) as a pedagogical technique facilitates the learner to (a) generate and test hypotheses about the behavior of a system by manipulating certain elements in the system model while keeping others constant, (b) distinguish cause and effect relationships in the system, (c) distinguish between facts and hypotheses and between relevant and irrelevant elements, (d) identify previously unclear interdependencies and associations within the system, and (e) develop adaptive decision-making and higher-order thinking skills (Allessi & Trollip, 1985; Crawford, 1966; Cunningham, 1984; Greenblat, 1975; Thiagarajan & Stolovich, 1978).

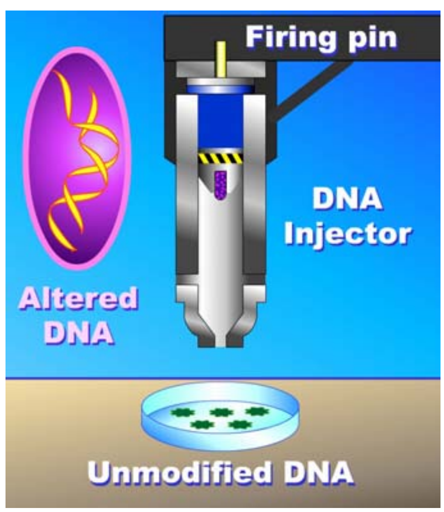

Figure 5. DNA Blaster Genetic Modification Procedural Animation (Source: Pat Grimaldi, 2D/3D Illustrator)

Finally, high-bandwidth Internet technologies can provide powerful heuristic scaffolding through content-enriching hyperlinks to constantly updated public Website databases (e.g., government agencies like NASA that can compare dynamic time-synchronized visualizations) to facilitate student research and student thought-question follow-ups for time-based data and information-rich resources (See Figure 6).

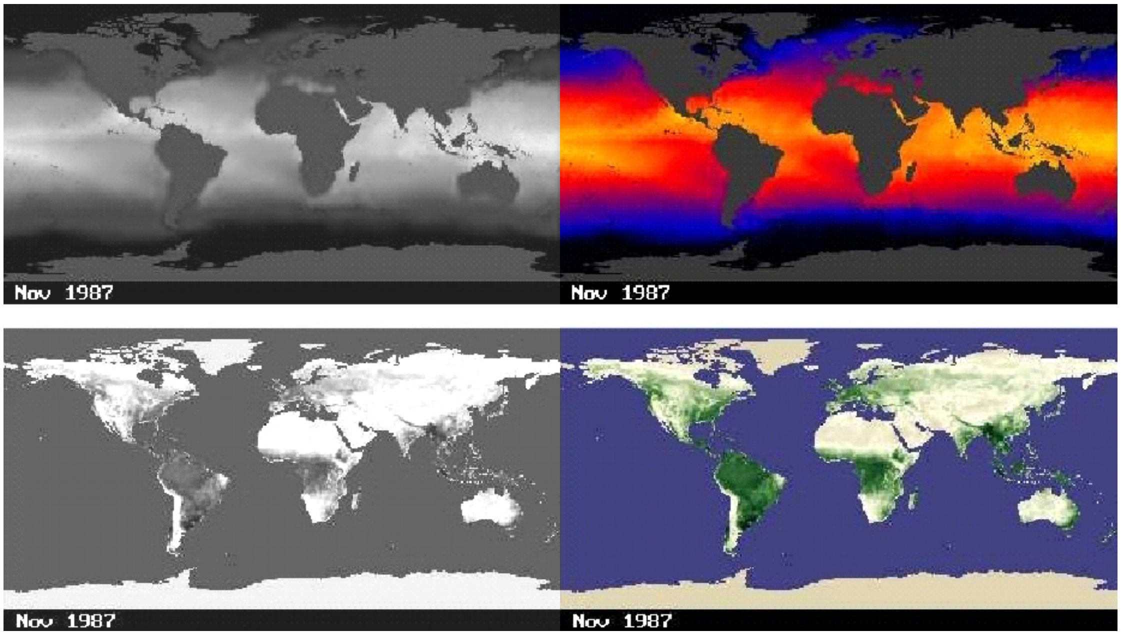

Figure 6. Synchronous Time-Based Dynamic Data Comparisons (Source: 2002: Geo-thermal & geo-forestation satellite data visualizations from public domain Website at http://www.earthobservatory.NASA.gov)

Integrating Content, Method, Function & Visual Form

As good teachers know, much of the content is actually the method. This is particularly relevant to incidental learning, collateral learning, creative and practical performance skills, heuristic and procedural knowledge, and problem-solving transfer capabilities long after the immediate content of the current lesson has been forgotten. To this end, efficiencies in the field of instructional technology will require a design synthesis towards the deliverable goal of fully-integrated media built within a research-based, theory-grounded, learner-centered, problem-oriented focal architecture based on the active acquisition of real, transferable skills and metastrategies, and authentically-assessed performance competencies. Optimal instructional graphics are thus intentionally designed to synthesize content and method, utilizing multiple modalities (a) to augment skill acquisition predicated on learning by doing; (b) bridging individual differences in learning style, preference, motivation, proclivity and capability; (c) integrating these differences with content domain knowledge driven by the glue of an outcomes-based, problem-oriented, goal-based, performance assessment of competency (i.e., mastery); and (d) providing a coherent, logically-consistent, robust systems design (i.e., recursively in terms of production process and instructional product, treatment intervention, and evaluation) to develop and implement a unified learning environment.

Summary

In summary, a number of prescriptive strategies for improving the visualization of knowledge can be proposed:

(1) Thoroughly organize course into macro-level and micro-level components. Use structured visual tools like outlines, timelines, flowcharts, both table-of-contents and index type lists, thematic logically-presented menus and concept maps to unambiguously convey this navigational structure to the student and assist course participation and wayfinding. For each course level, use advanced organizers with broader learning objectives, core topics, themes, concepts, and learner performance objectives clearly described in unambiguous language indicating measurable outcomes, assessment techniques, and demonstrable artifacts of competency.

(2) Embed illustrative case studies and relevant anecdotes within lecture scripts; embed associated student activities for deep, connected learning and reflection (i.e., not mere "note-taking" but reflective thinking higher-order skills requiring interpretation, analysis, evaluation, decision-making, weighing alternatives, projecting outcomes, proposing solutions, formulating original questions, problems, and causal hypotheses, creatively interconnecting ideas, juxtaposing examples and counter-examples) like first-person writing assignments (e.g., journaling), "action research" papers, local follow-up investigations, peer sharing (including peer tutoring, peer review/evaluation) related threaded discussion topics and student self-assessment "thought questions" within each module to enhance student interest, reflective thinking, connection to material and active/participative learning.

(3) Concrete concepts and key principles (e.g., change relationships and multivariate, co-dependent inter-relationships) should be conveyed via simple process animations; DVD & Web-based versions of these animations (using tools like Flash, QuickTime, etc.) and small streaming media demonstrations should be made available as learner-controlled (at a relatively discreet, disaggregated, short-duration, fine-tuned level of segment granularity), interactive time & motion process and parametric simulations, slideshows, multiple-path walk-throughs. Add non-lecture, on-location media components whenever feasible, including one-on-one interviews, peripatetic walk and talk slideshows; focusing on object detail close-ups in conjunction with case studies and problem examples as appropriate to enhance narrative interest and dovetail visual concepts; utilize appropriate reinforcement of real images or illustrations with abstract concepts and principles demonstrating change relationships.

(4) Reduce cognitive load by reconceptualizing aggregate and superordinate concepts into smaller information "chunks" (i.e., subconcepts, attributes and component elements). Modular course content can be further granularized into sub-levels (e.g., segments, mini-lectures) as feasible; again, content elaboration can be either Web-supported (e.g., outside hyperlinks, HTML/DHTML page text & images, slideshows, hyperlinked & annotated PDFs) or from other sources (e.g., hardcopy course reading materials).

(5) Re-conceptualize instructional systems models through the use of powerful visual metaphors like the example suggested in Table 2:

Table 2: *Use of Conceptual Metaphors in Representing Knowledge*

Building Architecture	Knowledge Architecture
buildings	courses, scope & sequence (curricula)
macro-design approaches	instructional design approaches
purpose & function of building	information design
properties of materials	media design
patterns of interior/exterior space	interactivity design
structure lifecycle (repair, improvement)	iterative courseware design
settlements, zones, cities	lesson activities, modules, units
power, water, air, transportation	courseware/online infrastructure

Conclusion

The unfulfilled promise of visualizing knowledge through effective information graphics will need to involve a pragmatic framework for (1) applying research-based theory and practice grounded in the fundamental first principles of an eclectic set of cross-disciplinary "best practices" from fields like instructional design, technical communications, information design, interactivity design, visual design, and media design while (2) fostering the systematic implementation of innovative, outcomes-based, problem-oriented, learner-empowering pedagogies capitalizing on current and emerging communication capabilities. We cannot separate content from method in instruction, nor educational philosophy from pedagogy—much as the courseware management and commercial online learning industries might like to disagree. Real learning will have to translate to real skills and extensible abilities (including the divergent-thinking ability to learn continuously on-the-job, develop analytic, heuristic and creative transfer skills and resolve novel problems operationally), and thoughtfully-designed information graphics can make an important contribution to this learning. William Blake's inspirational aphorism summarizes our ongoing search for a comprehensive visual language to communicate, to educate, and ultimately to create:

When the doors of perception are cleansed
Things will appear as they truly are.

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Sense and Nonsense in Online Interactions:
Can Non-Informative Exchanges Build a Community of Practice?

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Abstract

This paper describes preliminary findings regarding how seemingly nonsensical conversations in a synchronous Book Talk among elementary reading teachers might, in fact, support the development of a community of practice. Using Burnett's (2000) typology of exchanges for virtual communities, noninteractive and interactive online behaviors, as evidenced in the text -based 'talk', are explored. An analysis of conversation showed evidence of mutual engagement, joint enterprise and the development of shared repertoires, three activities related to the maintenance of coherence in communities.

Introduction

Today's prevalent practice of online chats and discussion forums through the World Wide Web dramatically transforms the technology landscape in relation to human behaviors. The widely used Internet gives rise to a social interaction phenomenon in which participants 'converse' using electronic textual messages as their means of communication. These emergent computer-mediated environments are more than merely as a source of information, entertainment, and basic communication. In some respects, the Internet becomes an alternative avenue for people's self-expression, stress release, professional development, search of identity, socialization, and social learning etc. (Burnett & Bonnici, 2003; Turkle, 1995).

By definition, online communities are "designed communities using current networked technology, whereas communities of practice emerge within the designed community via the ways their participants use the designed community" (Johnson, 2001, p. 45). Within the context of this definition, the term online communities covers the broad spectrum of both the synchronous and asynchronous forums such as web-based newsgroups, discussion boards, listservs, conferences, chat rooms and so forth. Regardless of the format or nature of these online communities, the underlying commonality that is pervasive among these rampant computer-mediated communities is the social dimension of communication. Thus, the complexity of communication in online communities caused by the void of face-to-face interactions and text-only discourse provides a fertile ground for the study of human interactions in these evolving virtual communities of practice. Much recent study on virtual communities has been devoted to topics on gender-related issues, online participants' communication styles, potentials and challenges of online communities within the realm of education (Ferry, Kiggins, Hoban, & Lockyer, 2000; Kreijns, Kirschner, & Jochems, 2002; Lapadat, 2002; Rogers, 2000; Soukup, 1999). Moreover, the impacts of online communities on the society as a whole, and the social interaction and communication of related issues are reported in the literature (Agres, Igbaria, & Edberg, 1998; Cummings, Butler, & Kraut, 2002).

In studies of both face-to-face and online conversation, the social and communicative significance of seemingly non-sensical conversation has been well documented (Preece, 2000). However, in online discussions in which teachers engage in professional conversation, "off-topic" or "whimsical" dialogue is often viewed as off task or time wasting. This paper examines the social aspect of a particular synchronous Book Talk among elementary reading teachers and describes preliminary findings regarding positive effects of seemingly nonsensical conversations in this environment might, in fact, support the development of particular aspects of a community of practice (Wenger, 1999).

Conceptual framework of the study

Much literature has addressed the different social aspects of community of practice, particularly in association with the burgeoning virtual communities in recent years. Moreover, studies on analyzing the actual dialogues or discourse patterns of virtual communities are diverse in scope and in theoretical framework. For example, Muramatsu and Ackerman (1998) studied the social management and arrangement of participants in a combat MUD community. From observations of the discourse among members of the game participants, the researchers found that meaning making resulted largely from collaboration and conflicts. Their dialogue analysis also identified significant differences between the social interactions of members depended upon the purpose of the virtual environments-- whether for entertainment and work for example. In a longitudinal study by Schoberth, Preece, and Heinzl (2002), actual email postings were analyzed for an understanding of the social behaviors of the online communities. Their quantitative analysis of three years' email messages from a German financial service provider revealed high correlation between information load, communication strategies and communication activities. Herring (1999), in her study of the structural and behavioral patterns of computer mediated textual communication, sought explanations for the complex incoherent nature of synchronous and asynchronous interactive exchanges. By analyzing samples of online dialogues, Herring (1999) found that the prevalent problems of topics decay, separated response sequence, exchange gaps and exchange overlapping in today's technologically determined online environments often create confusion and incoherence in their textual dialogues. However, her study indicated that online participants frequently sought compensatory strategies to adapt. Furthermore, many online users extend their creativity in the textual form of expressions by playing with words and manipulating textual expressions. Although the aforementioned literature concerns social interaction and communication, these studies do not explore how the complexity and multi-dimensions of social exchanges in online conversation relate to the development of a community of practice. Toward this end, the authors adopted Wenger's (1999) definitions of community of practice as the conceptual framework to examine the dialogues of a synchronous Book Talk among reading teachers.

According to Wenger (1999), a community of practice is one in which members engage in the same types of work and thereby experience a continual process of unfolding, integrating, negotiating, and development of related knowledge, expertise and support. The interwoven relationships of members in these communities of practice encompass three essential dimensions. They are mutual engagement, joint enterprise, and shared repertoire. Each of these dimensions has unique characteristics of interaction that maintain the coherence of the communities. For instance, mutual engagement entails the process of evolving forms of relationship and community maintenance; joint enterprise encompasses the process of understanding and turning their enterprise; and shared repertoire embeds the process of developing their styles, artifacts and discourses (see Figure 1).

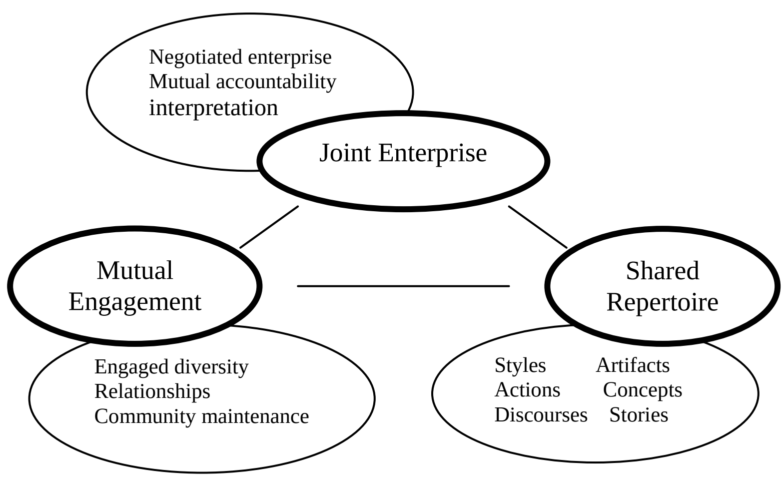

Figure 1. Dimensions of practice as the property of a community (Wenger, 1999, p.73).

As much online conversation is text-based, not surprisingly, it differs from face-to-face communication. Burnett's (2000) has developed a typology of social exchanges in virtual communities. According to Burnett (2000), both of these categories can be further divided into non-interactive or interactive behaviors of online participants. Within the interactive category, online talk and behavior can be either hostile or collaboratively interactive. In turn, the collaborative interaction category is further subdivided into behavior not specifically oriented toward information and those that are. The initial focus of this preliminary investigation of the conversation in a synchronized teacher professional development forum (chat) was on the information-oriented behavior in the Informative Interaction category. However, the authors began to question their tendencies to dismiss the joking or otherwise seemingly the non-informative interactions as irrelevant.

Methods

The Forum Description: Teachers.Net Book Talk

This qualitative study focuses on the archived transcript of a synchronous Book Talk session in Teachers.Net services, which is a division of Teachers Web. The motto of teacher-oriented website is "improving education through technology and collaborative support...together we share an incredible potential to change the face of education" (Bott, 2002, ¶ 1). The site is supported by educational organizations and "commercial enterprises seeking technical and promotional solutions to researchers of cutting edge theory and applications" (Bott, 2002, ¶ 2). AIG VALIC, an organization that offers financial services and products, is the major sponsor; others include Azusa Pacific University, Apples 'N' Acorns, LASIK for Educators, Meet the Masters NRTA, ReadingLady.com, and VIF. Aside from educational advertising by the sponsors, there are numerous instruction-related chat rooms, chat boards, live meetings, and topical meeting archives. Among the diverse chat forums in Teachers.Net, the archived chat meeting appeared to be the most appropriate for the observation of online community behavior. These archives are transcripts of live events in areas such as phonemic awareness discussions, or grade teachers' chat. Generally, live chat or discussion sessions take place at 9:00 p.m. Eastern Time in the Meeting Room.

In order to entice advertisers, Teachers.Net reported on their general demographics obtained during a seven-day data collection from 1200 voluntary participants taken in the fall of 1998. According to the note to potential advertisers, this Teachers.Net survey claimed to have 91.87% of teacher participants who made up 90% of the female surveyed population. Furthermore, among the 95% of college educated participants, 44.4 % of them received advanced degrees and the average age of the surveyed participants was 40.6years (see Table 1).

Categories	Unit Breakdown	Surveyed Results
Age of Participants	Average age	40.6 years
Curriculum Taught	Early Childhood	16.5 %
	Elementary	54.2 %
	Middle/HS	21.9 %
	Other	7.4 %
Education (Highest grade achieved)	HS	0.25 %
	Some College	2.68 %
	Assoc.	1.76 %
	Bachelor	51.26 %
	Masters	41.36 %
	Doctorate	2.68 %
Ethnicity	Caucasian	93.32 %
	AA	2.23 %
	Hispanic	1.71 %
	Multi	1.63 %
	Other	1.11 %

Table 1. Teachers.Net survey results - fall 1998

Categories	Unit Breakdown	Surveyed Results
Gender	Female	90.7 %
	Male	9.3 %
Marital Status	Married	73.8 %
	Single	26.2 %
Occupation	Teacher	91.87 %
	Ed. Student	3.6 %
	Admin.	1.97 %
	Other	2.56 %
School Type	Public	85.2 %
	Private	12.0 %
	Other	2.8 %

Student Age	Average	8.8 years
	5-9	52.0 %
	10-14	26.1 %
	15-18	7.3 %
	Other	14.6 %
Teaching Experience	Average	13.66 years

Table 1. *Teachers.Net survey results - fall 1998*

Like all the other free Teachers.Net chats and meetings, the chosen archived session, Book Talk, met as a scheduled real-time event. Starting its first session on April 17, 1998 with seven teacher participants, Book Talk has been meeting irregularly until March 2002 and continued weekly until the beginning of 2003.

Participants

Based on the content of the Book Talk transcript, participants were from various parts of the United States such as California, Michigan, Tennessee, Oregon, Illinois, and Virginia, and Canada. Gender, race, and ethnicity information was not available explicitly. However, gender was inferred by participant names, although we had no way to confirm our inferences. Participants also did not specify grade level they taught, although again, it appeared from the topics that several were elementary teachers. Participants were given pseudonyms in the Excerpts of chat logs that appear in this report.

Procedures

Access

The interest of the authors to explore the engagement of teachers in professional online discussions led to the search on teachers' discussion boards, chartrooms, and synchronous meetings. However, not many of the teacher related websites provided easy access to the information of online discussions without being a member. The selection of Teachers.Net among other similar teacher's online communities was largely due to the fact that accessibility regulation to the events and archived transcripts were readily available. For the purpose of this study, the authors chose Book Talk among other discussion sessions in the archive for the simple reason that the dialogues appeared to be lively and amusing. The authors contacted the online administrator of Teachers.Net to seek permission to use the transcriptions of Book Talk chat archives. However, we did not receive a reply. A consultation with our Institutional Review Board (IRB) indicated the exemption status of the current study as the logs of Book Talk chats are a publicly available resource and moreover had been posted on Teachers.Net before this study began.

Sample

Sampling in conversation analysis (CA) precedes from a different starting point, with different epistemological assumptions than that of sampling in quantitative frameworks (Mazur, 2004). Drawing on the insights from naturalistic observation and biology, conversation analysis justifies the use of 'specimens' of conversation. Specimens (in biological study, for example) represent the phenomena or organism under study that are directly observable in the particular individual. While such specimen sampling may have criteria, there is no need to sample statistically. For example, a biologist examining a species of tadpoles would simply choose individuals from that species. Perhaps, by observing the species in some natural setting, the biologist would not choose one that seemed highly unusual, but there would be no need for a statistical sample of tadpoles since it is the category of specie, the specimen, that is of interest. Similarly, a CA study might focus on any category of talk-in-interaction such as repairs and then simply select any specimen of conversation generated in a naturalistic setting. As Hutchby (2001, p. 51) has claimed, "The logic of CA, however, in terms of data selection suggests that any [his emphasis] specimen is a 'good' one, that is, worthy of intense and detailed examination (as quoted in Mazur, 2004)"

The Book Talk session took place on November 1, 2002 with 16 participants and 1025 exchanges. However, the observed portion has 50 exchanges among eight regular participants. The major themes of the selected discussion session centered on an upcoming conference, personal features such as hair color and age, school substitute issues, Halloween party, number of school days, phonics, readings, and issues related to teaching and class schedules. For analysis purposes, the archived chat logs were copied and formatted, which yielded 46 pages of transcripts. For ease of reference, the dialogue of the whole discussion session was numbered, which resulted in

1025 lines of conversation. Lastly, the names of participants were italicized and were given pseudonyms. From the formatted conversation, the researchers chose a specimen comprised of lines 71-121, that was termed the “Hair Talk” to enable generalization of observations on the talk-in-interaction of participants. Expecting a discussion of substance on children's book and reading in general, the researchers were initially disappointed then intrigued by the somewhat silly repartee regarding hair color and style that ensued. What meaning could such nonsense have in this self-initiated interactive context?

Gunawardena, Lowe and Anderson (1997) have cautioned against the sole use of conversation analyses to characterize the interactions in online forums. Their concern is that the focus on the details of talk-in-interaction may result in the loss of the so-called bigger picture, the meanings, of the conversation. They justify their position as follows:

> The totality of interconnected and mutually-responsive messages which make up the conference, and perhaps more: 'interaction' is the entire gestalt formed by the on-line communication among the participants. The process observed in the debate is akin to thinking on 'distributed cognitions' (Salomon, 1993, p. 256) where he states individual and distributed cognitions interact over time, affecting each other and developing from each other. (p. 407)

Analysis

Using the frameworks from both traditional conversation analysis (ten Have, 2000) and those that focus on online conversation (Herring, 1999), the Book Talk online discussion was analyzed. Turn taking, sequencing and content of conversation were examined for normative patterns in the conversation. These patterns were then related to Burnett's (2000) typology for exchanges in a virtual community and to the concepts from Wenger's (1999) notion of a community of practice, specifically, mutual engagement, joint enterprise and the development of a shared repertoire.

Analyzing the turn taking organization in a conversation is of foremost important, and is "one of the core ideas of the CA enterprise" (ten Have, 2000, p. 111). The basic idea of turn taking is the procedure of conversation that carries from one speaker to the next. During a normative conversation, the speaker selection, the tone of speaking, and the gaps in between responses are just some of the phenomena of turn-taking organization. Since online written dialogues do not exhibit the tone of speaking as in face-to-face communication, expressions such as exclamation and smiling symbols are often used instead. With speaker selection, the three prevalent ways that speakers exhibit their turn taking during a conversation are other-selection, self-selection, and continuation (ten Have, 2000). Each turn taking option illustrates the participants' actions within the context of the conversation.

Findings

Turn-Taking

Continual and self-directed turn taking was evident throughout the selected conversation specimen as demonstrated by the greetings of Terri, Todd, rita, amy, and kevin (see Excerpt 1, 71-75) to Annie. No one in particular suggests them to welcome Annie. In response, Annie does not hesitate in returning the greetings. Line 77 (see Excerpt 1) typifies an other-directed organization. Amy tries to find out the reason for Todd's earlier statement about his hair, which arouses her interest enough to direct the question to Todd.

The significance or likewise the insignificance of certain participants in the community often surfaces through turn taking analysis. From the same sample as above (see Excerpt 1, 71-76), all conversation come to a halt when Annie logged on to the session. The members welcome her with all kinds of expressive symbols (emoticons) to show their excitement in seeing her. On the other hand, no one acknowledges ted's presence when he starts to join the conversation (see Excerpt 2, 93). His statement regarding rita's hair is ignored. It is possible that he has been observing in the room for some time or perhaps he has just logged on and there is a delay in the posting his message. Either way, he does not seem to care about any acknowledgment of his presence nor is he concerned with invoking any further actions in announcing his presence.

Excerpt 1

71.	*Terri*	(((Annie)))
72.	*Todd*	Hi Annie!!!!!!!!
73.	*rita2a*	(((Annie)))
74.	*amy*	Hi Annie!
75.	*kevin*	Hey Annie!!!
76.	*AnnieL*	Hi Everyone!

77.	*amy*	Todd, why will you have small animals in your hair?

Sequence of Conversation

Very often, sequence interactional organization goes hand in hand with turn taking organization. Both of them are the backbone and core idea of conversation analysis. The basic concept of sequence organization is the implied response that is to follow a prior dialogue. For the reason of relevance to online conversation, the authors will include only responsive actions and presequence actions in the discussion. Response actions are frequently displayed in various forms of interactional conversation. Responses such as agreement, disagreement, acceptance, rejection, or correction (Goodwin & Heritage, 1990) are often associated with the promptness in responding to the speaker who initiates the statement, question or comment. Presequence actions is characterized by "preface requests, jokes and stories...news announcement...and invitations" (Goodwin & Heritage, 1990, p. 297). They often cause a change of action or response on the part of the hearer when faced with conflict.

In "The Hair Talk", Todd was the first to disclose information about his curly blonde hair (see Excerpt 2, 77, 78, 79, 81, 83, and 84) when amy asked about the "small animals" in his hair (see Excerpt 2, 77). By having an open ended sentence in his first reply (see Excerpt 2, 78), Todd seems reluctant in disclosing any information about his hair by avoiding to answer amy's question. However, he changes his mind by finishing with his reply on the next two entries of response (see Excerpt 2, 78, 81). From then on, Todd wants to find out the hair color of others by poking for information (see Excerpt 2, 95, 97, 103, and 108). Posting his question to kevin (see Excerpt 2, 97), Todd generates a seemingly reluctant responsive action (see Excerpt 2, 101) from kevin. Instead of answering the question that Todd posts (see Excerpt 2, 97), kevin raises a question in return, (see Excerpt 2, 101) which leads Todd to ponder on giving the response (see Excerpt 2, 102). Kevin's question (see Excerpt 2, 101) also signifies a pre-announcement that induces Todd to guess rather than to give him the answer. In the same token, the question that Todd directs to ted regarding his hair color (see Excerpt 2, 95) causes a similar reluctance in response from ted (see Excerpt 2, 99). The manipulation of responses by kevin and ted enables them to tease Todd. Todd's frustration in getting no reply from others is evident in his response in line 104.

Excerpt 2

77.	*amy*	Todd, why will you have small animals in your hair?
78.	*Todd*	Because I have so much of it.....
79.	*Todd*	Even the guy who does my hair jokes about it
80.	*rita2a*	Todd, LOL, I have straight used-to-be-blonde hair.
81.	*Todd*	It's naturally curly, which I now view as a blessing...but it is a chore to take care of
82.	*kevin*	todd you are not a blonde you are definitly a redhead I can tell from here
83.	*Todd*	Mine is blonde..with a little help. I have a lot of gray for someone who is 35, but well covered
84.	*Todd*	kevin...I do have some red in there too LOL
85.	*kevin*	Rita, you are a brunette
86.	*rita2a*	Todd, my Lit Coach (who I'm going with) isn't going to Keene's presentation--so I'll be alone there. I'll definitely look for you.
87.	*kevin*	you guys are ruining my ESIA member schema
88.	*rita2a*	kevin, ROFL
89.	*Todd*	I told my fellow teachers I'm dropping my bag at the hotel and heading over. They can check me in
90.	*AnnieL*	The presentation is next week?
91.	*Todd*	Yes, Annie. I get to meet Rita
92.	*rita2a*	yup Annie
93.	*ted*	Rita is NOT a brunette
94.	*kevin*	I know that now, I'm trying to adjust
95.	*Todd*	ted, are you a brunette?
96.	*AnnieL*	No, Rita is blue.
97.	*Todd*	kevin...and you?
98.	*Terri*	Terri's gray -- just letting it do its thing.
99.	*ted*	natch
100.	*rita2a*	ROFLOL
101.	*kevin*	What do you think Todd?

102. *Todd* Hmmmmmmmmmm, ted, blond?
103. *Todd* Ummm, well, uh, blonde? kevin?
104. *Todd* Thanks everyone for leaving me out here all alone. LOL

Content of Conversation

The content of this non-sensical "Hair Talk" conversation reflects a distinctive tone and style. In excerpt 3 below, there is evidence that these participants really know their fellow Book-Talkers in ways that suggest a sense of belonging and true insights into identity. Participants appear to be very comfortable with each other and they seem to know each other well enough as to tease (perhaps even bait) each other.

Excerpt 3

71. *Terri* (((Annie)))
72. *Todd* Hi Annie!!!!!!!!
73. *rita2a* (((Annie)))
74. *amy* Hi Annie!
75. *kevin* Hey Annie!!!
76. *AnnieL* Hi Everyone!

} Color the Atmosphere

86. rita*2a* Todd, my Lit Coach (who I'm going with) isn't going to Keene's presentation--so I'll be alone there. I'll definitely look for you.

91. *Todd* Yes, Annie. I get to meet Rita

117. *rita2a* Todd,I'm a lot older than you, but I'll probably leave the cane at home.

118. *kevin* And I have thin thighs, long legs and buns of steel too

} Members appear to know each other well

Discussion

These seemingly non-sensical online interactions of "The Hair Talk" conversation derive purpose in their potential to support dimensions of activities inherent in communities of practice. Specifically, within the dimension of mutual engagement, members of the community discover ways to interact with each other, build relationships, establish identifies, find out others' identities and explore their strengths and weaknesses. The self-directed and continual greetings when someone logs in reveal the willingness of Book Talk participants to develop and maintain engaging, welcoming mutual relationships (see Excerpt 1, 71-76). Their greetings also signify their acknowledgment of others' identities. For instance, through other-directed organization, amy, one of the eight participants, learns how to develop a repertoire (styles, actions, artifacts) with Todd. Her initiation in questioning about Todd's hair is intentional and meaningful (see Excerpt 1, 77).

Members in a community tend to share a common goal (joint enterprise). They learn through the process of understanding and tuning their enterprise. In the process of working together to solve disagreements and conflicts, members develop mutual accountability, and align their engagement from negotiations. From the specimen, it is evident that Todd's frustration indicates his struggles in defining the enterprise and his coping with the conflict. His effort in resolving the confusion at hand indicates his accountability to the other participants. The way that ted and kevin lead Todd into frustration demonstrates their understanding of their own community (albeit put to somewhat negative ends), the members, and the boundaries within the community (see Excerpt 2, 93-104).

According to Rogers (2000), "meaning is negotiated in a community through its shared repertoire. This repertoire refers to the fact that there is a pool of resources that members not only share but also contribute to and therefore renew" (p. 388). New ideas are generally created through the shared repertoire. For instance, despite the fact that this particular online chat is a book discussion session, the participants have no reservation to renegotiate the meaning or purpose of the discussion session (see Excerpt 2, 87-94). They develop their own style in relating to and in learning about each other. These interactions also indicate a strong sense of belonging. They also learn to color the atmosphere of the chat environment by showing excitement in welcoming others (see Excerpt 3, 71-76), and being playful.

Conclusion

Initially, the selected Book Talk conversation appeared to be trivial nonsense, especially considering the fact the participants were reading teachers in a book discussion session. The commentary on each other's hair color do not have any bearings on the rest of the conversation related to upcoming conferences, specific books and upcoming holidays at school. In fact, the conversation seemed somewhat immature. On the other hand, this mundane conversation, which is prevalent in many ordinary social conversations and interactions, may possibly have significant implications.

The selected specimen of exchanges were primarily non-informative (Burnett, 2000). Within the 'non-informative' frame, the analysis showed that this kind of seemingly irrelevant online interaction supported a) mutual engagement, b) joint enterprise, and c) development of a shared repertoires - three activities related to the maintenance of coherence in a community of practice (Wenger, 1999).

The relevance of seemingly off topic or tangential utterances should be no surprise to those who are familiar with conversation analysis of talk in face-to-face contexts. However, systematic analysis of how these types of interactions play out in on-line chats has been lacking. These reading teachers log in week after week to Teacher.Net seeking out other teachers. For them it appears that there is potentially much sense in the nonsense of seemingly non-informative online interactions as they may relate to the development of a community of practice. In fact, the insights reported here about these non-informative interactions may help to explain the persistence of these voluntary, online professional communities. Further analysis of the details on online talk-in-interaction my reveal additional information regarding how online talk relates to the building, maintenance or erosion of communities of practice.

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Using a Wiki Learning Environment in a Secondary Education Classroom

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"Not all advances in instructional technology come about through the development of new hardware or software - some emerge from the *creative applications of existing technology*." (Wiley & Edwards, n.d., p. 2, emphasis in original)

What's Wrong with What We've Got?

The middle school bell rings and 32 students in second period history stand up and file out the door on their way to English or math or band. Over the next five minutes 34 third period students trickle in—some to find their seats and pull out reading books, others to chat with a friend, and others only to drop their books on a desk and rush back out for a couple of minutes of socializing and note exchanging in the hallway. As the tardy bell rings, all students rush for their assigned spots and, as the last bell tone dies, the last student's bottom hits the last open chair. Pavlov would be impressed!

What happens between the starting and ending bells of a class period may vary widely from day to day, but in the broadest sense it is hoped and assumed that learning is occurring. It is also a pretty safe bet that instruction is expected to play a major role in that learning process—particularly at the middle school level. What many people, including teachers, seem to forget is that the practice of instruction and the practice of learning are not simply two sides of the same process. This is because the teacher's goals of instruction may or may not be the same as the students' goals of learning—either for a single student or for an entire class. It may also be the case that the methods that the teacher uses for instruction are incompatible with the student's mode of learning.

Perhaps the term "education" is general enough to cover both processes. Education may refer to the teaching by a single instructor or by the whole school system. Education may also be used to describe what a learner "gets" in a classroom—the results of their participation, or the process by which those new abilities and understandings are acquired. Ask, then, of the goal of education at the secondary level and you are more likely to find general agreement among teachers: Students will: (1) learn the subject matter for core courses that prepare them for college and/or productive careers, (2) become self-regulated life-long learners, and (3) develop better moral character or citizenship. So, how are we doing on those three fronts? In most seventh-grade classes we are doing very poorly! The ideal student is one who sits quietly and does each assignment without questioning the teacher, the assignment, or the textbook. We test thoroughly to see if the students retained the subject matter at least until test day; we encourage self-regulation unless they get 15 minutes behind; we reduce "life-long" to the end of the current grading period; and we convince them that citizenship refers only to the number of times they talked without raising their hands or strayed from their assigned seats.

Is There Any Other Way?

Most of the burden for initiating, maintaining, and evaluating learning falls upon the teacher. Because of that, the emphasis is on instruction rather than on learning. A number of educational theories that have been developed over the past few decades, loosely combined under the label "constructivism", seem to pull the focus of education from teaching to learning. Even an understanding of what learning involves changes with a contructivist approach—from reproduction of information to the notion that information must be transformed by the learner for meaningful learning to occur (Cullen, n.d.). Constructivist learning requires that students, preferably groups of students, be able to work with information, cognitively and socially, to make the information meaningful for the individual learners. As Cullen (n.d.) points out, constructivist learning is a negotiated process. Negotiation occurs between the teacher and student regarding learning activities and the management of the learning environment. Negotiation may also occur regarding the selection and use of sources of information. Negotiation is also critical between individuals in the social learning environment.

Negotiation implies a shared understanding of the division of responsibility and authority or control between the teacher and the students in the learning environment. Despite educators' goals of developing self-regulated life-long learners, they are very reluctant to surrender much control to the students. When they do, it is for a very short time. A lot has been written about giving students control over their learning - some authors emphasize the benefits while others focus on the negative consequences. One point on which most authors tend to agree, however, is that students and teachers generally lack the skills and the experience necessary to negotiate effective learner control.

There is yet another point of negotiation that I think is the most critical for learning—the interaction between the learner and the source(s) of information. Although it may be a stretch of the definition of negotiation, I believe that it effectively describes the way in which a student interacts with a lecture, a passage in a textbook, a discussion with a neighbor, or any other source of information. In a one-on-one conversation with a teacher or another student the learner has considerable control. Even in a class-wide lecture situation there are opportunities for students to interrupt the flow of information to ask for restatement, clarification, or extension of ideas, though such interruption is sometimes challenging to accommodate with large classes in the mass (public) education system. Ideally, students can negotiate meaning with others until all parties are completely satisfied, but it is not so easy to negotiate with a textbook.

The Holy Textbook

The textbook has been the center of attention in most secondary social studies classrooms for several generations. It brings together in a concise form much of the information that is relevant to a given topic, accompanied by photos and maps and other learning aids. It organizes the information in a logical way, and it makes the exact same information available to every student in the class and to the teacher.

Now if students would just read it. So teachers give worksheets and assign questions within the chapter to be answered to make sure they do read it. But they still don't. (After first making sure that no one around them has the answer to give them), students scan the text for one of the key words in the question. Likely as not, the teacher will get the next seven words, directly from the text, as the answer—whether or not they even make sense. Students will have forgotten the question and the answer before they even move on to the next one, and as for understanding it or thinking about it—not a chance. So we assign them to take notes or to write an essay about the information in the chapter. What we get from most students is a brief synopsis of the chapter (a few lines verbatim from the text)--long enough to claim that they worked very hard and yet sloppy enough so that the teacher doesn't want to read it carefully to see that they didn't.

How do you get kids to actually think about what they read, or see in a video, or hear in a class discussion? How do you get students to become critical consumers of information, who then actively and purposefully transform that information into meaningful learning in the constructivist sense? I think a major part of the problem is the textbook and the way it is used in the classroom. Siegel and Sousa (1994) complain that the traditional textbook, "with its emphasis on chapters and units, dictates the flow of ideas in the classroom. It does not easily allow students and teachers to depart from the prescribed path." (p. 49) The path the text takes has probably been prescribed by a group of professionals who are experts in the subject matter, in pedagogy, and in editing. It largely controls the sequencing, pacing, and depth as well as the content of what is to be learned. Teachers appreciate the fact that the difficult task of locating, selecting, and sequencing information is done for them—leaving them the monotonous but easy task of correcting worksheets and recording scores. But students are led to think that the chapter contains all relevant information, organized in the only logical way.

It's the organization of knowledge that really concerns me. Apparently it is of great concern to nearly all learning theorists as well. Many years of serious thought and research have been spent trying to understand how the human mind encodes and retrieves information and how we give meaning to that information. Scores of cognitivist and constructivist theories attempt to describe how the mind works and to prescribe instructional approaches based on those understandings. Siegel and Sousa's (1994) sharpest criticism of traditional textbooks is that teachers and students are forced down the prescribed path in a linear fashion that "neither reflects nor encourages natural human learning." (p. 49) Although the expert path may be appropriate when learning some skills, such as parallel parking, it is clear that this approach can be very limiting in a subject like history, where links to a wide variety of concepts and facts, both within and without the history discipline, are important towards increasing comprehensive understanding. Even the experts cannot prescribe a single path that is best for multiple individual students.

How can students get the information that they need about a subject, with enough structure to keep it coherent, but enough flexibility so that it more accurately follows the way they individually process information? How can they practice metacognitive skills that would help them to monitor and adjust and improve their own processing of information according to their unique, individual abilities and interests? Allow students to assume more control over the information that they encounter, particularly over the way it is organized!

Creating Multiple Texts from One

Computer and Internet technologies make it possible to do many things with information that we cannot do with printed books. Although there may be some drawbacks to the rise of electronic writing and reading, such as a decline in the concern for spelling skills, the benefits far outweigh those drawbacks. One innovation in particular, hyperlinks, allows the reader to effortlessly and immediately link to additional information and back again at will. Hypertext, a term coined by Theodor Nelson in the 1960's (Landow, 1992), attaches links to additional information to specific words and phrases in the online text. Even very young children know as they surf the Internet that clicking a word that appears in a different color, usually blue, and especially if it is underlined, will take them to additional, related information.

Twenty years ago a number of children's books appeared that allowed the reader to determine the way the story unfolded based on decisions that they made. A second reading of the book, with a few different decisions by the reader, would likely produce a different ending to the story. In much the same way, hypertext allows the reader to determine, to some extent, the way in which a document will be read, based on the links they choose to follow. Landow (1992) wrote that "hypertext blurs the boundaries between reader and writer." (p. 5) This occurs because the reader assumes some control over how the document will be read and continually changes the focus by selecting a particular path of hyperlinks. Spiro and Jehng (1990) describe the different paths that might be taken as producing "essentially *multiple texts* for the same topic." (p. 166, emphasis in original) Lehrer (1993) describes the paths as "multiple voices" (p. 201) and I think that describes the effect of hypertexts well because it suggests that multiple readers will have different experiences as they travel through the larger body of work. The key is that the reader has been given some control.

So, putting a hypertext textbook online would solve the textbook issue, right? It would make the textbook less constraining and it might also make it more accessible. However, it makes the management of learning activities and evaluation of learning more challenging for the teacher if each student is now reading their own unique "version" of the text. And it really doesn't address the more serious problem—that students don't really read the textbook anyway. They need to have a reason to *carefully*, *critically*, and *repeatedly* read the text—they need to write it!

Make Me Want to Write

Few students like to write, and almost no students would be excited about the prospect of reviewing and revising their work to the degree that would be necessary to produce a basic text on any subject. From the hundreds of excuses students may have for not writing well, only a handful can legitimately be resolved by direct instruction. The majority of excuses boil down to a lack of motivation on the part of the student. Vincent (1993) describes three conditions that must be met before students will become totally involved in major writing projects: "(1) they must be turned on by the project; (2) it must include a broad, well-defined audience; and (3) the project must be in some sense 'published' to convince them of the importance of proofing or editing." (p. 58) Although the teacher may employ some strategies to encourage motivated participation in such a project, I believe the most effective strategy is to construct a learning environment that features three different motivating factors: technology, increased learner control, and positive social reinforcement.

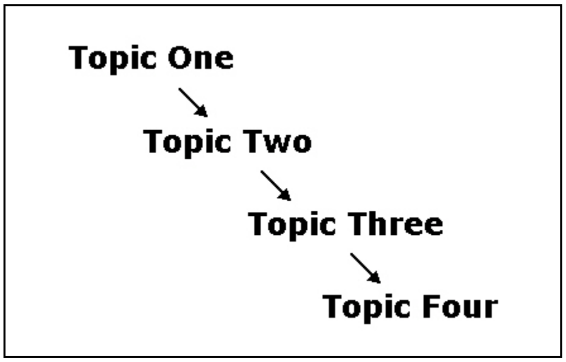
Finally! -- The Wiki Environment

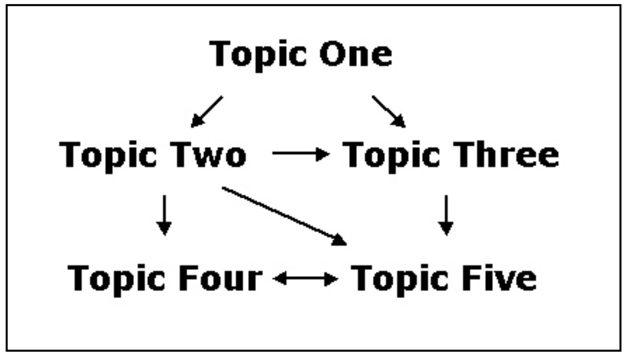
The Wiki is an online environment that incorporates many of the ideas that have previously been mentioned. It is a workspace where students can create and modify hypertext documents, and it becomes a showplace for their evolving masterpieces. Developed several years ago by Ward Cunningham and his colleagues at Georgia Tech (Leuf, 2001), the wiki is far more than a web site where students post their work. The wiki server allows students -- actually anyone who views the site -- to add to or to edit existing content and to manage text pages with the click of a button and without any technology skills beyond basic keyboarding.

As the wiki learning environment is described throughout the next few pages it may be helpful to explore an example of a very successful wiki site on the Internet. One site that seems to work well because of its large, active community is an attempt to create an online encyclopedia based on the distributed expertise of the users. This is found at www.wikipedia.org. The wiki that I used for my classes was hosted on a server belonging to Dr. David Wiley at Utah State University. Students access the wiki environment using an Internet browser. Most wikis are very simple in terms of their layout so that they can be accessed by nearly any computer and any browser. Within the wiki the student may choose to start a new topic by naming a page with a "wiki-word" title. A "wiki-word" is formed by putting two capitalized words together without a space, such as WealthyNations. Unless this topic is later renamed, it will always be available in the wiki under that name. If a student wants to link to another topic that they, or another student, has written, the student simply types in the wiki-word name of the desired topic and the link is automatically created. The wiki word is also shown in blue to indicate that the link has been created. If the student creates a link to a page that does not yet exist, the link will still be shown in blue, however it will be followed by a question mark to indicate that the page does not yet exist, or that it does not yet have any content. If a student clicks on a link with a question mark, the blank topic will still be shown and the student can then add content to that topic. When their work is saved, the new topic is available online and the question mark after the link will be removed.

The organization of topics within the wiki is controlled only by the strategies students use to link to them. Some topics flow naturally from one to another as shown in Figure 1. Others could be linked more as a web as shown in Figure 2. Ideally, topics would be limited to individual ideas so that there is more flexibility in linking

Figures 1-2: Topic Organization Diagrams





them together. As the number of topics on a particular subject increases, the organizational possibilities also increase--this is an important feature of the hypertext learning environment.

As students read existing topics, they also have the opportunity to edit those topics. Anyone can edit any topic in the wiki, regardless of who created it initially. When a student clicks an edit link at the end of the topic, that topic is locked to other users so that only one person at a time can make changes. Changes are made to the topic as they would be in any basic word processor. Text can be added, deleted, or replaced. Links to other topics can also be changed or added. When the changes are done, the student clicks a save link and the server immediately updates the topic. If the student returns to the Web browser, they can see the new version of the wiki, though they may need to refresh the browser first.

The last saved version of each topic is displayed in the wiki. However, all previously saved versions are also readily available. A previous version can be restored simply by selecting it and saving the topic again. This may be valuable in an educational situation where topics become accidentally or intentionally corrupted. Because anyone can change any topic at will, it is possible for students to damage other students' topics. However, because unwanted changes can be discarded with a couple of mouse clicks, damaged wiki topics are not a serious threat and students who intentionally cause damage soon learn that their efforts are not time/cost efficient.

Most wiki environments are set up so that there are at least two separate publication threads going on at the same time. One thread is the main web of topics that the students write for all to see. Behind the scenes, however, is a second discussion thread that students use to carry on a kind of meta-conversation about the topics they are publishing. The discussion side of a topic may include extended explanations for the topic's contents, justification for changes they have made, or questions that are yet to be addressed.

In addition, there may be meta-pages for the entire site. These may include guidelines for site development that the community of learners might follow that influence organization of topics or the directions the content development will go. This area would also contain a help page with a users' guide for working within the site. This page may also include a place where students (and others) can post questions to be answered by any other user. If the wiki gets very complex and the community is very active, it would be necessary to assign one or more students to monitor the meta pages and maintain some degree of organization.

As the students become familiar with the affordances and the flexibility of the wiki environment, it will begin to develop a particular style. It may take some positive experience with the environment, but students will eventually become very familiar with how the wiki works and a core group of students will emerge who show great interest in, and responsibility for, the wiki. Although it is difficult to isolate independent factors that make the wiki a motivating and productive learning environment, I think it is important to consider the three aspects that were previously mentioned: technology, social reinforcement, and learner control.

Technology

As a whole, the research findings are inconclusive regarding the use of technology in schools simply because there are so many different variables and combinations of variables that are included in the many studies. The same is true for the kind of technology that the wiki larning environment represents. However, two meta-analyses on hypertext and hypermedia (Chen & Rada, 1996; Liao, 1998) acknowledged positive overall effect sizes when using such tools. These reviews of studies indicated improvements not only for learning outcomes, but also for social interaction. Such tools or environments encourage students who typically do not get involved in traditional classroom discussions or in face-to-face exchanges to communicate with others (SRI International, n.d.). Because working in the wiki is so easy, it encourages participation by all of the students. They see the results of their efforts immediately, which further increases their motivation to continue.

Two concepts associated with the constructivist approach to education are highlighted by the technology of the wiki. The first is the concept of "affordances", a term coined by Gibson (Driscoll, 2000) to describe the impact of the environment on an organism's behavior. Gibson argued (Driscoll, 2000) that an organism's behavior, in this case that of a student, was controlled by its perception of the affordances of the environment. A student who thinks they will learn something new from a movie about tigers is more likely to pay close attention to the movie and is far more likely to learn than a student who perceives the movie as a waste of time. Riel (1989) describes the use of computers in the classroom as a "recontextualization of learning" (p. 188). I think that describes what happens when students encounter the same information in the wiki environment that they might otherwise have seen in a textbook or heard in a lecture. The new environment gives the same information new life for the students. Student interest is focused on both content and on the tool used to present it. The wiki, despite its simplicity of use, can be used to create very intricate hypertext webs. As students perceive the possibilities that the wiki, as a tool, can provide, they will be further interested in using the tool and in exploring those possibilities.

One of the more practical affordances of the computer and of the wiki is the ease with which changes can be made. Although most writers make minor changes as they write, students revise their work more frequently when they are using a computer (Soven, 1999). This revision includes not only simple editing, but holistic revision of their work. The computer screen becomes a focus for students' attention. Unlike a textbook, the screen is constantly changing as the student's focus shifts and as they update the information there. The screen *affords* the student the ability to see the results of their construction of knowledge (Tourney-Purta, 1996). Because it is so easy to make changes, and because those improvements can be immediately seen on the published wiki, students are inclined to revise more often. The quality of the product is increased, the student has practiced desirable behaviors (they did the assignment), and they are motivated to do more work, and better work in the future.

The other important constructivist concept deals directly with the value of hypertext for learning. Spiro and others (Spiro, 1992) developed a theory of learning called Cognitive Flexibility Theory. Consistent with many other learning theories that conceive of knowledge as concepts that are individually stored in the brain as well as the relationships between those concepts, Cognitive Flexibility Theory suggests that learning is enhanced as many different pathways or relationships between stored concepts are established. A student would be more knowledgeable if he or she could link the same collection of concepts in many different ways. It may also be described that the student is more creative in his or her ability to work with that body of information.

Spiro and his associates have also developed an instructional theory, called Random Access Instruction, that derives from Cognitive Flexibility Theory. They promote (Spiro, 1992) the use of hypertext environments, particularly in ill-structured domains, because students are able to explore many different paths through the same material. There is repetition of the content, but not replication because they take different paths and are likely to get different perspectives.

Social Influences

It is often difficult for writers to view their own work from other perspectives. That is one reason that the wiki is best used as a collaborative writing environment. The concept of collaboration has been interpreted differently in education. As many teachers do, I have put my students into small groups to work on particular projects with the expectation that all members of the group would contribute to the project in one way or another and with the expectation that they would all learn form the results of their combined efforts. What I have come to accept is that "combined efforts" are not often "collaboration." A group report on sharks is usually a collage of four separate reports on sharks pasted together. Ask one student about the report and they may answer, "I don't know! I did the part on what they eat!"

The wiki learning environment is very susceptible to co-authorship rather than collaboration. Whether the wiki responsibilities are shared by small groups or by whole classes, it is critical that the content and the organization of content is the result of social negotiation. This negotiation should also not be the kind that is typical of most peer groups when they are asked to review each other's work and give feedback. Most students are reluctant to critique others and seldom give specific feedback, if any at all (Soven, 1999). Thus, as Bednar et al point out (Bednar, 1992) "Sharing a workload or coming to a consensus is not the goal of collaboration; rather, it is to develop, compare, and understand multiple perspectives on an issue." (p. 28) Collaboration will be enhanced as group participants not only share knowledge, but use those multiple perspectives to construct meaningful artifacts (Resnick, 1996). In such a setting, "children view their peers as resources rather than as competitors." (Lunenburg, 1998, p. 3)

Learner Control -- Let 'em Run

It takes time for groups to exchange viewpoints and considerable more time for students to understand and appreciate the viewpoints of others, particularly if the students are not accustomed to group work in this way. Although they may require more supervision by the teacher at first, the collaborative process will begin to take over as the students become comfortable with each other and as they begin to honestly consider the thoughts and work contributed by each member of the group. As they gain confidence in their abilities to produce quality work, students also change their perception of their relationship with the teacher. Lehrer (1993) reported that students perceived themselves on a more equal footing with the teacher when they found the subject, in this case history, to be one that they discovered and interpreted themselves rather than waiting for the teacher to tell them what was true. "Teachers become participants in the students' activities and students become critical consumers of the teacher's activities." (Guzdial, n.d.). The reality is that students become more critical consumers of their own work as well--both product and process.

Part of the reason that students rely less and less on the feedback from the teacher is that they begin to recognize "holes" in their understanding. The wiki environment makes it easy to identify, and to fix "holes" in the online products. At first it may be necessary for the teacher to review the students' hypertexts and to insert blank links whenever a concept needs to be further explored or where appropriate relationships between concepts have not been identified. A blank link in the wiki is indicated by a question mark after the linked term. They are easy for the author to find, but they do not interrupt the flow for the reader. As Leuf and Cunningham (2001) point out, there are no broken links in a wiki--only opportunities to add more content. (p. 22) It is important for students to learn to recognize holes themselves, and it is important that they learn to see those holes as "opportunities." Recognizing what a student does not know is valuable if they see it as a way to improve themselves rather than as a failure (Scardamalia, 1989).

The more that students perceive that they have been given control over the learning environment, the more they will begin to recognize that the emerging product is a direct result of their efforts. Students assume ownership of the results of their efforts. Because the wiki environment is open to all--because anyone can change anything at any time--there are some important considerations for use as a learning tool. One recommendation is that it be closed to editing by anyone who has not registered as part of the group. This will reduce the likelihood that students' work will be negatively altered. Also, it is recommended that students be required to register with their real names. Anonymity may increase the contributions of some reluctant participants, but it is important that students attribute changes, be they better or worse, to a real person rather than to an unknown entity to which they have no recourse. The obvious implication is that students will probably not intentionally harm another student's work if their identity is clearly attached to their changes.

As I conducted my own experiment of the wiki learning environment with two of my seventh-grade classes, I was particularly interested in the concept of ownership and how it would be affected as students, under assignment, edited and revised other student's wiki products -- both within their own class and for students from the other class. I was very surprised to learn that most students were neutral regarding changes made by other students. However, one important trend did emerge. Students who felt that their pages were made worse through the revisions by others were highly possessive of their pages and were more critical overall of the wiki environment. Students who saw the revising as an improvement, and they were in the overwhelming majority, reported that the pages belonged to everyone and generally approved of the wiki experience.

Implementation

The physical establishment of a wiki learning environment is not overly difficult. It requires a special server and an Internet site. Most school districts have the hardware and expertise to make it happen, but they may be reluctant to create the site and to pay for the URL because wikis are so uncommon and there are important issues about allowing students direct access to a district-hosted site.. Dr. David Wiley at Utah State University has been gracious enough to host our experimental site because of the research potential and I hope that the school district will be willing to assume responsibility for its maintenance when I can show them the value it has as a learning tool.

Similar to the reluctance that may be found among district personnel, the major barrier to implementation within a school or a class is that it is a definite departure from what has traditionally gone on in secondary classrooms. I have experimented with the wiki learning environment in a classroom that has had a strong cognitivist and reception learning atmosphere. I found limited success for the majority of students, though there were a few who excelled within this new environment. As described earlier in this paper, the wiki is more suited to a constructivist approach. As Fosnot (1992) points out, the teacher is the key, "I have seen well-designed materials and instructional environments . . . totally misused by teachers who meant well but who held strongly to objectivist and transmission beliefs and thus interpreted the material's use through their model." (p. 175) The teachers are often uncomfortable with the constructivist requirements of the wiki experience and take back control of the learning process too quickly. (Simmons, 1993) Speaking directly about a wiki-like experience, Scardamalia et al. (1992) suggest that it requires an epistemological shift and not merely a methodological one.

The students have also been found (Jonassen, 1992) to struggle with the constructivist approach if they are not used to it because they expect to be evaluated on their ability to spit back the correct answer rather than on their ability to work within the evolving environment and construct that environment as they do. Helping students to adjust to different learning styles will require patience and practice. Some students will make the transition better than others. Cullen (n.d.) found that the "more able" students seemed to get more out of this kind of activity. Lehrer (1993) recognized that the "more-successful" students were on task more often, but that the "less-successful" students gradually became more involved in the project.

Conclusion

Internet-based teaching methods are not new to the classroom, but they are only slowly coming into more general use as the availability of hardware improves in the schools. The ability and eagerness of educators to try these newer tools is also slowly improving as the influx of technology-trained teachers attacks the persistent school culture of the last century. The wiki learning environment may be just the tool that some of these forward-thinking teachers will employ because it is inexpensive and easy to use, and because it helps to facilitate the goal of creating motivated and independent learners. It remains to be seen if the social-learning and constructivist philosophies that are required to make it fully successful will be able to infiltrate the school culture as well.

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The Virtual Instructional Designer: A Just In Time Instructional Design Tool

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Abstract

The Virtual Instructional Designer (VID), a web-based instructional design tool, is available for free and at your personal disposal 24 hours 7 days a week. The VID accommodates the needs of the novice and experienced online instructor in creating online or mixed modality courses. An example of how this tool was used to create an online developmental psychology course at Indiana State University will be demonstrated.

Introduction

The VID - The Virtual Instructional Designer (VID) is a Learning Anytime Anywhere Partnership (LAAP) grant-funded project from the Department of Education. The VID was created as a web-based performance tool to be used by post-secondary faculty for designing web-based distance courses. Instructional design teams at Indiana State University, Ivy Tech State College, and Vincennes University developed this project. Indiana State University serves as the lead institution and houses the VID project. The three-year grant for this project began in August 1999 and ended August 2003.

As web-based instruction continues to grow in popularity, the resources for developing web-based instruction have not increased to meet this demand. The Virtual Instructional Designer (VID) was developed to meet this demand and provide faculty with readily accessible and individualized instructional design assistance. Although this tool was designed for use by post-secondary faculty, instructional designers as well as teachers at the K-12 level can use the VID.

The VID can be used to create a learning unit as well as an entire course. It may be used as an instructional design reference tool. The VID provides faculty and instructional designers with 24/7 desktop access instructional design assistance. This assistance includes the following:

- Creating an effective course design and layout
- Establishing goals and objectives
- Linking goals and objectives to course content
- Designing authentic assessments and assignments
- Encouraging student engagement with course content
- Incorporating multimedia into course content

Material developed with the VID can be used by various courseware management systems including Blackboard and WebCT. More important, the VID is easy to use. There are no thick manuals to read or complicated instructions to follow. The VID, with its vast resources, is easy to navigate and use.

Background

In recent years, Indiana has been looking for innovative ways to reduce the number of students who fail to complete an associate or a bachelor's degree. The Degree Link Program was established to resolve this problem. The Degree link partnership between Indiana State University (ISU), Vincennes University (VU), and Ivy Tech State College (Ivy Tech) allows traditionally underserved students to earn their associate degrees at partner institutions and then complete selected bachelor's degrees at ISU. It was determined that the most effective way to offer degree programs and courses was through asynchronous, online courses. Partner institutions were now faced with the challenge of providing cost-effective, quality faculty training in the design and management of online courses.

Ms. Paula Vincini, former instructional designer and project leader at Indiana State University, was instrumental in developing plans for the Virtual Instructional Designer (VID). Moreover, Ms. Vincini was largely responsible for forging the relationship between partner institutions, Ivy Tech State College (Ivy Tech) and Vincennes University (VU), in the pilot testing and analysis of this project.

The Project Team Included:

- Grant Project Director
- Project Leader (Instructional Designer)
- Web Applications Programmer
- Web Graphic Designer
- Web Content Developers
- Graduate Student Workers

In addition, instructional designers (and faculty) from Ivy Tech State College and Vincennes University were involved throughout the development and pilot testing of the VID.

Demonstration

Access

The Virtual Instructional Designer (VID) is a web-based tool that provides instructional design assistance to faculty and instructional designer. Here are the steps for accessing the VID:

1. Go to http://vid.indstate.edu
2. Click "New User"
3. Fill out the New User form
4. Click Submit

A username and password will be generated and sent to the email address that you included on the New User form.

Design and Layout

The VID is designed to provide optimal ease in navigating its more than five hundred pages of content. The Home page contains a page side navigation bar, top navigation bar, and a main window. The page side navigation bar allows you to access the seven major content areas of the VID: **Jump Start, Communicate, Content & Assignments, Motivation, Evaluation, Media & Technology,** and **Tutorials**. The top navigation bar includes a search, glossary, FAQs, site map, and tour (orientation area). A **My Features** area, located at the top right of the page, contains an area for taking notes, creating a VID plan for course design, and a bookmark function for marking pages of interest.

Content

Content within the VID includes best practices, examples from faculty experiences, current research, instructional design advice, and information regarding media and technological advances. This content is divided into seven areas: **Jump Start, Communicate, Content & Assignments, Motivation, Evaluation, Media & Technology,** *and* **Tutorials.**

Jump Start provides a "big picture" about online courses as well as how to get started designing instructional activities. Communicate provides information on how to design quality discussions. Content and Assignments gives information on how to create and adapt content for online use. Motivation provides insightful information on how to create and maintain an online learning community. Evaluation covers various topics such as designing authentic assessments and evaluating groups. Media & Technology addresses learning style issues related to the incorporation of audio and video components in online courses. Tutorials provide important information on how-to skills for developing instruction such as digitizing course material or transforming documents into portable document files (PDF).

How to Use the VID

The Virtual Instructional Designer (VID) is designed to assist you with at least three types of instructional design assistance:

1. Creating online course components (e.g., syllabus, lecture notes, assignments and assessments).
2. Exploring specialized topics (e.g., learning communities, experiential learning, and learning styles)
3. Planning and revising a course (e.g. inventorying, sequencing, and incorporating course material/multimedia).

Use the search function or click on a content module to find information about online course components or specialized topics. If you are planning and/or revising a course, there are two areas of the VID that you may use: My Features and Jump Start (Managing the Design Process). Click on **My Features** drop down menu and select *My VID Plan.* The *My VID Plan* link will take you to the Faculty Needs Survey (Figure 1). Select items in this survey that pertain to your course needs, and click Submit. The survey generates a learning plan consisting of links to pages in the VID that you can read and take notes on (Figure 2). Next, go to **Jump Start** (content module) and click on *Managing the Design Process.* This section includes a step-by-step process for planning your course (Figure 3).

Here are some sample artifacts of the design process.

Figure 1. Faculty Needs Survey

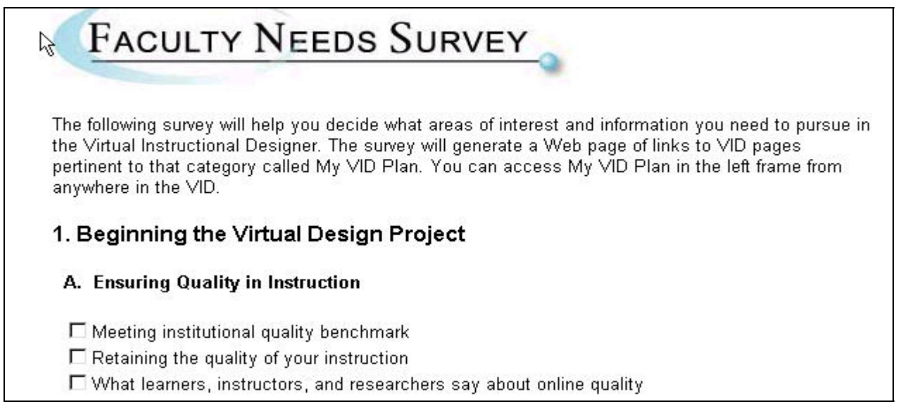


Figure 2. My VID Plan

Figure 3-1. Managing the Design Process

Managing the Design Process

You've just agreed to transform your face-to-face course for online delivery a year from this semester, or you may simply want to enhance your traditional course with web-based activities.

Either way, you must begin to think of yourself as a **Project Manager** because of the complexity of designing these interactive, learner-centered, technology-based learning environments

You will need a **systematic**, **organized plan** to manage your design and development process and one way is to use the following four step process for creating a Course Design Blueprint.

Even if you only plan to introduce Web-based groups or discussions to your course, these steps can be modified to create a solid design blueprint to follow.

Figure 3-2. Managing the Design Process

- **Creating a Course Design Blueprint**

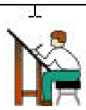
Step 1: Inventory Your Course Activities

Look at the face-to-face course and create a Course Inventory Grid of what happens with and to students throughout a typical semester. Models are provided for you to use or revise.

Step 2: Analyze Communication Strategies and Your Learner's Goals

Now that you have an inventory of course activities, assignments, and communication, take some time to analyze course communications and the goals and characteristics of your online learners. What potential challenges appear in terms of continuing to use traditional classroom methods?

Figure 3-3. Managing the Design Process



Step 3: Analyze Course Learning Goals & Learning Objectives

Because the goals and objectives for your course will determine the basic design framework for the instructional strategies you will use, the content you will present, and the nature of your evaluations, create a final G & O grid. This provides the beginning for your blueprint.

Let's begin by taking a short 'quiz' on goals and objectives.

Course Learning Goals and Learning Objectives

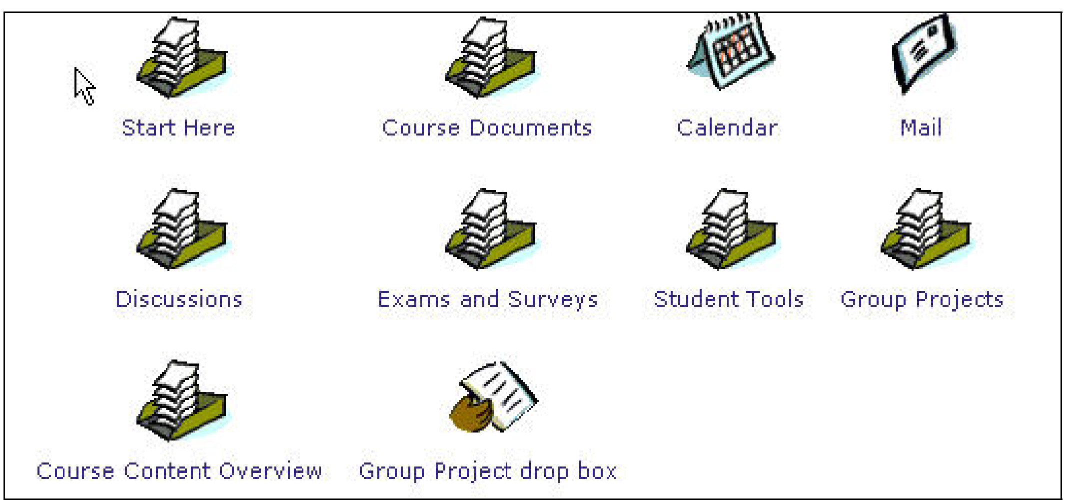
- Writing Clear and Effective Learning Goals
- Writing Clear and Effective Learning Objectives

Goals & Objectives Grid

- Bloom's Cognitive Taxonomy
- Developmental Psychology Goals & Objective Grid
- Nursing Leadship Goals & Objective Grid

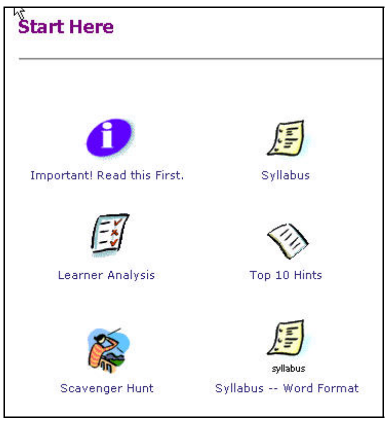
Application to Course Development

Indiana State University



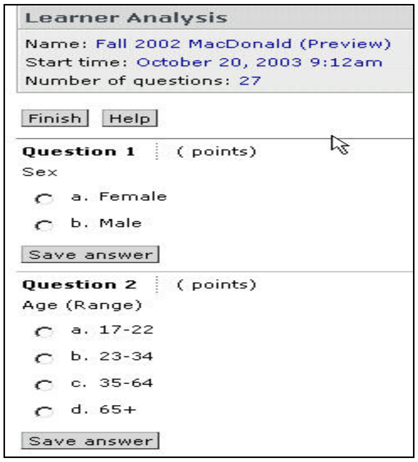
The VID can be an invaluable tool for developing online courses, as it was in developing this online undergraduate developmental psychology course. Using the VID was an eye-opening experience in terms of how to help students succeed in this course from the very beginning. The section on designing a course orientation (under "Jump Start") was particularly helpful. For example, in order to make students familiar with the course site, the VID suggested creating a "scavenger hunt" quiz (see Figure 4). This involved putting together a list of questions about the course, such as: "How many practice quizzes are you required to complete?" and "Find the names of two other students enrolled in the course". In order to successfully complete the scavenger hunt, students must navigate different parts of the course site. In this course, students can find answers by finding the syllabus, the calendar, the instructor's website, the class roster, and the netiquette guidelines. The other advantage to the scavenger hunt is that it allows students to practice taking a quiz online.

Figure 4. Scavenger Hunt



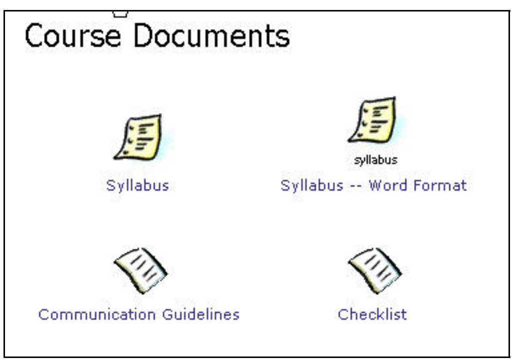
Another suggestion from the VID that was incorporated into this class was the use of a learner analysis (see Figure 4). This survey asks students for information not only about their technical skills and previous experience with course content and distance education courses, but also about their expectations for the course and some basic demographics. The learner analysis serves several functions. It provides information relevant to student's chances of success in the course and the types of support that they may need. The demographic information collected (gender, age, major, number and age of children, if any) is used to divide students into groups for their group projects in such a way as to allow for maximum diversity of viewpoints on development within each group.

Figure 5. Learner Analysis (partial view)



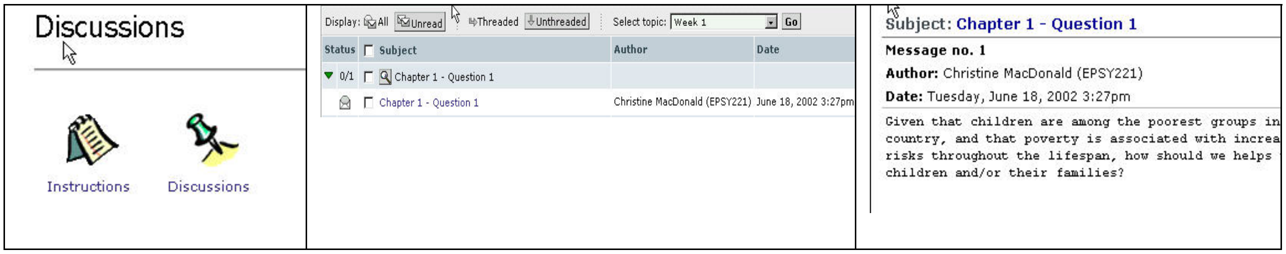
A particularly helpful section of the VID is on the behaviors of successful online students and how to encourage students to engage in these behaviors. One of the characteristics of successful online students is that they monitor their progress in the course. Therefore, multiple supports have been provided for students to help them do this. These include making students aware of the accessibility of the online gradebook (and letting them know how often grades will be updated) as well as their "attendance" records. Since students are required to perform a number of activities each week (read assigned chapters, read the week's online content overview, participate in discussions, take practice quizzes, and work on group projects), a checklist of each week's activities was also created to keep them on track (see Figure 6).

Figure 6. Checklist of Weekly Activities



The "Content & Assignments" section of the VID contains useful information about learning activities and how to best design them for online courses. For example, the module on lectures requires the faculty member to do very thoughtful analysis of why they want to post lecture notes online, what those notes should look like, and how online lecture notes might differ from traditional lectures. This analysis led to the conclusion that if the textbook did a good enough job of explaining the content, there was no real need for that content to be replicated online. One of the goals of this course was for students to be able to interact with the content at a deeper level and be able to apply it to real life situations. Thus, lecture notes were not posted. Instead, students respond to a series of asynchronous threaded discussions throughout the semester (see Figure 7).

Figure 7. Threaded Discussions



These discussions involve critical thinking about issues related to material from that week's reading, and involve integration of text material and life experiences with case studies or real life issues and events. The "Designing Threaded Discussions" unit of the VID (under "Communicate") was used to design the evaluation rubrics and criteria associated with these discussions. Students have available to them online a list of criteria used to evaluate their weekly discussion contribution, as well as specific examples of graded discussion contributions. Each example also includes a rationale for the grade assigned. The VID also includes a statement on how much the final course grade course discussions should count for, in order to assure student participation.

Summary

The Virtual Instructional Designer, developed as a part of a Department of Education grant, is a web-based instructional design tool that can be used to develop online courses. The VID was developed to assist the Degree Link Partners, IVY Tech State College and Vincennes University, in developing online courses for underserved students who wish to complete their bachelor's degrees at Indiana State University.

The Virtual Instructional Designer (VID) is designed to assist you with at least three types of instructional design assistance:

1. Creating online course components (e.g., syllabus, lecture notes, assignments and assessments).
2. Exploring specialized topics (e.g., learning communities, experiential learning, and learning styles)
3. Planning and revising a course (e.g. inventorying, sequencing, and incorporating course material/multimedia).

An example of how this tool can be used is illustrated by the design of a Development Psychology Course (EPSY 221) at Indiana State University. Sections of this tool, Jump Start, Contents & Assignments, and Communications, were used to create effective course components including: orientation/scavenger hunt, learner analysis, various tools for students to monitor their progress, and threaded discussions.

XML Primer and eLearning Applications

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Abstract

XML (eXtensible Markup Language) is one of the latest buzzwords. What is it? How is it related to HTML? Is it worth learning? Is it hard to learn? How can it be used in eLearning applications? This presentation will address each of these questions and more. It will include a description of a simple tutorial application that shows the power of using XML to separate content, presentation specifications and interaction strategies.

Introduction

XML is an acronym for "eXtensible Markup Language." XML provides a mechanism for marking or tagging information or data. The marks or tags serve as metadata, or data about the data. These descriptive tags can provide clues as to the structure and meaning of the data. Let's examine the simple well-formed XML document shown in Figure 1.

```
<?xml version="1.0"?>
<library>
    <book>
        <title>Instructional Design, 2nd Edition</title>
        <authors>
            <author>Patricia L. Smith</author>
            <author>Tillman J. Ragan</author>
        </authors>
        <copyright>1999</copyright>
        <publisher>John Wiley and Sons, Inc.</publisher>
        <cover src="coverArt.jpg"/>
    </book>
    <book>
        <title>XML for the World Wide Web</title>
        <authors>
            <author>Elizabeth Castro</author>
        </authors>
        <copyright>2001</copyright>
        <publisher>Peachpit Press</publisher>
        <cover src="XMLCover.jpg"/>
    </book>
</library>
```

Figure 1. A well-formed XML Document

As shown in Figure 1, the data or content is divided into elements that are enclosed within opening and closing markup tags. The metadata markup tags are emphasized in bold. Thus, the content, "Instructional Design," is enclosed within the tags, **<title>** and **</title>.** XML opening tags begin with the symbol **<** and end with the symbol **>**, while closing tags begin with **</** and end with **>**. Note that the **<author>** tags are nested inside of the **<authors>** tags, which are nested in turn inside of the **<book>** tags. This nesting of tags organizes the content elements into a hierarchical structure. Tags that contain no content, such as **<cover** src="XMLCover.jpg"**/>,** begin with the symbol **<** and end with **/>**. Embedded within the <cover> tag is an attribute, src, and it's corresponding value, "XMLCover.jpg".

The example XML document shown in Figure 1 is said to be "well-formed" because it conforms to a few rules outlined in the XML specification such as the following:

1. Each XML element has matching opening and closing tags. Empty tags that contain no content may use the shorthand notation shown with the cover tag in Figure 1.
2. The XML document has one root element within which all other elements are nested.
3. All elements are properly nested
4. Attribute values are enclosed in quotes.

One of the reasons XML is referred to as “extensible” is because the labels that make up the tags are not predefined. Authors of XML documents can use any tag labels they desire. The tags have no inherent meaning of themselves. Meaning is imposed on them by the author. Thus, the author should use care in choosing tag labels that provide meaningful descriptions of the data.

How is XML related to HTML?

HTML and XML are both based on the more complex Standard Generalized Markup Language (SGML). XML is a simpler subset of SGML, while HTML is an application of SGML (Flynn, nd). HTML (Hypertext Markup Language) is used to markup data to indicate how it should be displayed on a web page. In contrast, XML is used to indicate the meaning and structure of the data. XML was not necessarily designed to replace HTML. XML and HTML serve different functions (XML Tutorial, nd). To highlight these differences, let’s examine a simple HTML document shown in Figure 2.

```
<HTML>
	<HEAD>
		<TITLE>Simple HTML Example</TITLE>
	</HEAD>
	<BODY>
		<H1>Books</H1>
		<HR> <BR>
		<B>Title:</B> Instructional Design
		<BR><B>Authors</B>
		<UL>
			<LI>Patricia L. Smith
			<LI>Tillman J. Ragan
		</UL>
		<IMG SRC="coverArt.jpg">
	</BODY>
</HTML>
```

Figure 2. Simple HTML document

As can be seen by comparing Figure 1 and Figure 2, there are many similarities between XML and HTML. Both documents contain content along with markup tags. The XML tags describe the content, while the HTML tags often specify how the content is to be displayed. For example, <B>Title </B> from Figure 2, specifies that the word “Title:” should be displayed in boldface type. The <HR> tag specifies that a line or horizontal rule should be displayed on the screen. The <UL> tag indicates that the following items should be displayed as a bulleted (or unordered) list. Some HTML tags such as the <H1> tag serve duel purposes. <H1> indicates that the embedded content is a level one heading, but also indicates that the heading is to be displayed in large boldface type preceded and followed by a blank line.

In contrast with HTML, the XML document shown in Figure 1 contains no information on how the information or data is to be displayed. This is both an advantage and a disadvantage. The disadvantage is that the way the XML document is to be displayed in a web browser must be specified by a separate style sheet document. The advantage is that the content or data is separated from the presentation specification. This allows us to modify the style sheet to change the way the data is displayed without modifying the data. We can also use the same style sheet for different sets of data. It also allows us to use the XML data for multiple purposes. Style sheets will be discussed in more detail in a subsequent section.

Why XML?

Although XML documents with meaningful tags are easily interpreted by humans, their great value lies in the fact that their formal structure also makes it possible for them to be easily interpreted by computers. This makes XML documents ideal for the interchange of information or data over the Internet (Bryan, 1997). Because XML documents can be stored in standard text files, and they are independent of platforms, hardware, operating systems, software or applications, they can by used and processed by a wide variety of applications for many different purposes (XML Tutorial, nd). XML is already being used for many applications Harold (2001).

For example, the Chemical Markup Language (CML) is an XML application used to represent complex chemical data such as molecular structures. Mathematical equations can be represented using Mathematical Markup Language (MathML) and sheet music can be represented using the XML application MusicML. Two-dimensional vector graphics can be described using other XML applications such as Scalable Vector Graphics (SVG) or the Vector Markup Language (VML). Figure 3 shows the XML for an SVG document describing several vector graphic objects such as a circle, rectangle, ellipse, line, and a polygon.

```
<?xml version="1.0"?>
<svg xmlns="http://www.w3.org/2000/svg">
    <circle  r="30" cx="35" cy="35" fill ="red" stroke = "blue" stroke-width = "2" />


     <rect  x = "95" y = "10" width ="30" height = "50" rx = "5" ry = "10"/>
    <ellipse  cx = "200"  cy = "35"  rx = "50" ry = "20" fill = "gray"/>
    <line  x1 = "15"  y1 = "100"  x2 = "75"  y2 = "150"  stroke-width = "2"  stroke = "green"/>
    <polygon points = "100,100 100,150 150,150" stroke-width = "2" stroke = "blue" fill = "yellow"/>
</svg>
```

Figure 3. XML document using Scalable Vector Graphics (SVG).

Jon Bosak (1999) has marked up all of Shakespeare’s plays and four religious texts (the Old Testament, the New Testament, the Koran and the Book of Mormon) into XML. Figure 4 shows a portion of the XML document for Shakespeare’s Hamlet.

```
<?xml version="1.0"?>
<PLAY>
    <TITLE>The Tragedy of Hamlet, Prince of Denmark</TITLE>
    <PERSONAE>
        <PERSONA>CLAUDIUS, king of Denmark. </PERSONA>
        <PERSONA>HAMLET, son to the late, and nephew to the present king.</PERSONA>
        *****
    </PERSONAE>
    <ACT>
        <TITLE>ACT III</TITLE>
        <SCENE>
            <TITLE>SCENE I.  A room in the castle.</TITLE>
            *****
            <STAGEDIR>Exeunt KING CLAUDIUS and POLONIUS</STAGEDIR>

            <STAGEDIR>Enter HAMLET</STAGEDIR>
            <SPEECH>
                <SPEAKER>HAMLET</SPEAKER>
                <LINE>To be, or not to be: that is the question:</LINE>
                <LINE>Whether 'tis nobler in the mind to suffer</LINE>
                <LINE>The slings and arrows of outrageous fortune,</LINE>
                *****
            </SPEECH>
        </SCENE>
    </ACT>
</PLAY>
```

Figure 4. Portion of Shakespeare's Hamlet in XML

As Harold (2001) suggests, the advantage of marking up Shakespeare's plays in XML is that it makes it possible for a computer to analyze and manipulate the text in a variety of ways. For example, a version of a play could be printed which highlights the lines of a particular character in bold face.

Later in this paper, I will show how XML can be used to represent content in e-learning applications. But, first, let's see how style sheets can be used with XML to specify how the XML content should be presented in a web browser.

What is a style sheet and how is it used with XML?

Most pages on the Web are coded in HTML. As mentioned earlier, these HTML documents combine the content and presentation specifications in one document. In contrast, XML documents usually do not contain any presentation specifications. If you want to display the content of an XML document in a browser, you can prepare a separate style sheet that provides the corresponding presentation specifications. Figure 5 presents an example of a style sheet that specifies how the Library XML document shown in Figure 1 might be displayed.

```
library {font-family: Palatino, Garamond, Times, serif; margin:20pt}
title, author { display: block; margin-bottom:10pt}
title {font-size: 18pt; color: red; font-style: italic; font-weight: bold}
author {font-size: 14pt; text-indent: .25in}
copyright, publisher {display: none}
```

Figure 5. Style Sheet for the Library XML Document

The style sheet shown in Figure 5 consists of a set of five rules for how to display various elements of an XML document. These rules conform to the Cascading Style Sheet (CSS) specification (http://www.w3.org/Style/CSS/).

Each rule begins with the name or tag of the XML element to which the rule should be applied. The name is followed by a list of styles, within brackets, that are to be applied to elements with that name or tag. Thus, the first rule specifies that all of the content nested within the root library tag should be displayed with a serif font and within a margin of 20 points. The second rule specifies that the contents of a title or an author tag should be displayed in a separate block or line with a bottom margin of 10 points. The third and fourth rules provide additional styles that are to be applied to the title and author tags respectively. The fifth rule indicates that the content of the copyright and publisher tags should not be displayed.

These rules would be saved in a separate file with a .css suffix, such as “library.css”. The second line of the corresponding XML document should contain a processing instruction that would instruct a Web browser to use this style sheet to determine how to display the XML content: <?xml-stylesheet href="library.css" type="text/css"?>. Figure 6 shows a screen shot of how the XML document shown in Figure 1 would be displayed using the style sheet from Figure 5.

Figure 6. Screen shot of XML document using style sheet from Figure 5

Simply simply changing the style sheet can dramatically modify the look and feel of the XML document. Figure 7 shows an alternate presentation of the same XML document using a different style sheet.

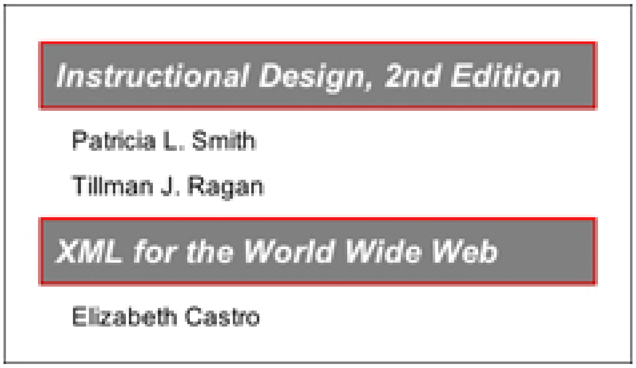

Figure 7 Screen shot of the same XML document using an alternate style sheet

The real power of style sheets becomes apparent when a single style sheet is applied to multiple documents. A change to the common style sheet will automatically result in a change to all of the corresponding documents.

How can XML be used in elearning applications?

Many elearning applications available on the Web are also coded in HTML. Simple HTML elearning documents are generally static and just provide information. More sophisticated elearning applications include interaction. Students are asked to respond to practice situations and corrective feedback is provided for their responses. Such interactions are made possible by adding computer-programming code to the Web page using a scripting language such as JavaScript. This approach combines the content, presentation specification and interaction code into the same document.

By placing the content in an XML document, it is possible to separate the content, the presentation specification, and the interaction script. This separation facilitates maintenance and reuse of all three separate elements.

Let's now look at a simple tutorial for teaching the concept of "adjectives" that demonstrates how this separation could be implemented in an elearning application.

Figure 8, 9 and 10 show screen shots of three pages from the tutorial. Figure 8 shows a page that presents a definition of the concept. Figure 9 shows one of several pages that present examples of the concept, while Figure 10 shows one of several pages that provide students with an opportunity to practice identifying the adjective in an unencountered sentence.

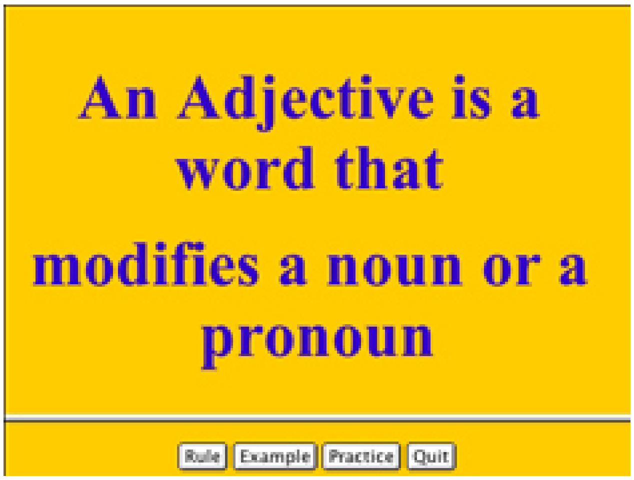

Figure 8. Screen shot of the concept definition page.

Figure 9. Screen shot of an example page.

Figure 10. Screen shot of a practice page.

The text of the examples and practice items are not hard coded in HTML. Instead they are stored in external XML documents. Figure 11 shows the XML document for the example items, while Figure 12 shows the XML document for the practice items.

```
<?xml version="1.0"?>
<EXAMPLESET>
    <EXAMPLE>
        <SENTENCE>I want some apple pie.</SENTENCE>
        <COMMENT>Apple is an adjective, since it modifies pie.</COMMENT>
    </EXAMPLE>
    <EXAMPLE>
        <SENTENCE>Where is my red pencil.</SENTENCE>
        <COMMENT>Red is an adjective, since it modifies pencil.</COMMENT>
    </EXAMPLE>
    <EXAMPLE>
        <SENTENCE>This is a wonderful conference.</SENTENCE>
        <COMMENT>Wonderful is an adjective, because it modifies conference.</COMMENT>
    </EXAMPLE>
</EXAMPLESET>
```

Figure 11. XML document for Example items

```xml
<?xml version="1.0"?>
<PRACTICESET>
	<PRACTICE>
		<ITEM>Jane has a sports car.</ITEM>
		<PART WORD ="Jane">noun</PART>
		<PART WORD ="has">verb</PART>
		<PART WORD ="a">article</PART>
		<PART WORD ="sports">adjective</PART>
		<PART WORD ="car">noun</PART>
	</PRACTICE>
	<PRACTICE>
		<ITEM>The sky is sure blue.</ITEM>
		<PART WORD ="The">article</PART>
		<PART WORD ="sky">noun</PART>
		<PART WORD ="is">verb</PART>
		<PART WORD ="sure">adverb</PART>
		<PART WORD ="blue">adjective</PART>
	</PRACTICE>
	<PRACTICE>
		<ITEM>That is a pretty dress.</ITEM>
		<PART WORD ="That">pronoun</PART>
		<PART WORD ="is">verb</PART>
		<PART WORD ="a">article</PART>
		<PART WORD ="pretty">adjective</PART>
		<PART WORD ="dress">noun</PART>
	</PRACTICE>
</PRACTICESET>
```

Figure 12. XML document for Practice Items.

The XML document in Figure 11 contains tags for the sentences and comments that will be displayed when the student clicks on the Example button. The XML document in Figure 12 contains tags for sentence practice items and tags that identify the part of speech for each word in the practice sentences. These part-of-speech tags make it possible for the computer software or interactive script to construct unique, informative feedback messages for any anticipated student response.

The content of the examples and practice items can be modified, or additional items can be added without changing one line of the computer program or script that controls the interaction and feedback. On the other hand, the XML practice document can be reused without modification to teach the concepts of “nouns” or “verbs” by only changing the value of a single variable in the computer script for teaching “adjectives.” Figure 13 shows the screen shot from the modified tutorial that uses the same XML practice document to present “noun” practice items.

Figure 13. Screen shot of "noun" practice item.

In addition the tutorial uses an external style sheet to control the format of the presentation. By making simple changes to the style sheet, the background image or color and font characteristics of the tutorial pages can be modified without changing the HTML, interaction script, or XML. An example of the effects of different style sheets can be seen by comparing Figures 10 and 13.

Thus, by using XML to markup the content materials and style sheets to specify the presentation format, the reuse of the content and the interaction script is facilitated. In fact, the tutorial can be replicated using other authoring tools such as Flash or iShell, which can read the same XML files without modification.

Summary

This paper has shown how XML (eXtensible Markup Language) can be used to markup or tag content. Since XML documents, with meaningful tags, can be easily interpreted by humans as well as computers, they are ideal for the interchange of information. XML documents have proven useful in a variety of areas including chemistry, mathematics, music, literature, graphics, and eCommerce. This paper demonstrated how XML could be used as a tool for developing eLearning applications where the content, presentation specification and the interaction script can all be separated from one another. This separation facilitates maintenance and reuse of all three separate elements.

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Ethical Issues In Copyright Compliance and Fair Use Guidelines in Teacher Education

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Abstract

There is an alarming lack of awareness of both copyright law and fair use guidelines in educational setting. Students at advanced stages of secondary education frequently do not make the connection between plagiarism and abuse of copy rights, and public schools do not appear to be actively promoting copyright compliance by students or teachers. Fair use guidelines are also not readily understood by licensed educators and seldom known by students. Multiple issues fuel the breaking of copyright compliance: (1) lack of funding to purchase materials, (2) lack of understanding of the economic benefits of copyright, and (3) lack of awareness of the fair use guidelines. Although fair use guidelines are provided for educators and students there still remain the unresolved issues of protection of intellectual properties of teachers and students as well as availability free, quality resources to promote educational reform.

Why, in a society rich with information and an exponentially expanding reservoirs of accessible resources, our public educators the least likely to understand how to access and use these materials and the least likely to pass on an awareness of copyright laws to their students? This should not be a debatable issue; however, I have found this to be true in many of the educational settings I have worked in as well as studied in. Now as faculty in a teacher education program, I am again surprised at the lack of awareness of copyright laws by students entering my program and also at the lack of compliance shown within educational settings they have emerged from. This discussion is an attempt on my part to find solutions to this issue for my students and my colleagues.

Problems

Low Levels Of Literacy About Copyright

After analyzing the content of response papers submitted by students over a two-semester period of time, I discovered that more than 50% of the students did not know that copyright law applied to educators. There was a genuine response of surprise. In light of the fact that all of the students were either at the junior level of college or had already received degrees and were returning to obtain licensure for teaching, this was surprising to me. Many of the students expressed the idea that even through they were aware of copyright law; they did not think copyright law applied to teachers and that teachers were free to use any materials available to them in any manner they desired. This is a very disturbing idea to emerge out of any population of students. These students were new into the teacher education program and had no or little exposure to actual courses within the program. The conclusion is inescapable: the public education system had not created environments that promote the idea of protection of intellectual properties nor of the right of the creator of products to control access to those products.

"I knew there were such laws, but I was under the impression that the enforcers of the laws skipped over us or turned their heads because we were educators and the information was there for us to educate the youth of this great nation." (JM)

> "I never knew there were so many limitations when incorporating copyrighted materials into your own presentations and works. I always thought that I just needed to cite my sources to be all right. Most of my classes taught me what plagiarizing was and how to avoid it, but I never learned about copyright laws for the use of multimedia products." (CD)

These statements and sentiments were echoed throughout the responses from five sections of entry-level technology students. Many of the students made the connection between plagiarizing and copyright laws but some did not. Most were surprised by the complexity of copyright law and fair use guidelines. Many were discouraged by copyright protections and many others were happy to find the fair use guidelines outlined by the Consortium of College and University Media Centers[1]

Perhaps as disturbing but not unexpected was the finding that most of the school districts contacted in a survey did not have any formal way to promote copyright compliance. Research was conducted on six school districts surrounding the university. The school districts are both urban and rural. The three urban districts have a total student population of over 101,000. The three rural districts have a total student population of a little over

16,250. The largest urban district has 60,000 students, and the smallest rural district has approximately 1,000 students.[2]

The survey included the following questions: Does the district have a person(s) serving as a technology specialist(s) who informs teachers and students about: (1) First Amendment protection, (2) filtering and blocking obscene material, (3) use of students' personal information and education records, (4) downloading and storing copyrighted material, (5) fair use, (6) defamation in Internet communications, (7) and E-mail harassment?

> *Each of the six districts had a person designated as a technology specialist who has responsibility for First Amendment protection, filtering and blocking obscene material, proper use of students' personal information and education records. Each specialist was also responsible for the correct downloading and storing of copyrighted materials, fair use practices, defamation in Internet communications and E-mail harassment. None of the six districts reported that they had addressed First Amendment protection issues, defamation in Internet communications or E-mail harassmen.[3]t*

Additional questions in the survey included ones related to policy on copyright liability, training for new teachers, Codes of Ethics/Conduct, and signs warning users of the misuse of materials. These were the findings:

- *Three of six districts had a board policy on copyright liability.*
- *Each of the six districts had an acceptable use policy. Three districts out of six train new employees on copyright issues and acceptable use policies. The largest urban district reported that their technology personnel train others from a book, but the training usually consists in just answering questions when a problem arises rather than any formal training. They also reported that their Code of Conduct book is very general.*
- *No district had any acceptable use policies in a code of ethics/conduct manual for teachers or for students. Only one district had acceptable use policies in their Teacher/Administrator and Classified Employee manual. One district had a brochure on acceptable use policies.*
- *District personnel were unsure whether there were posters around copy machines in their various schools where the misuse of copyright laws were posted.[4]*

It is a reasonable question to ask that if indeed copyright laws were being complied with consistently within educational environments, why were only half of the school districts creating any policy to guide compliance? And conversely, if an awareness of copyright laws were pervading the school districts thereby not requiring any kind of board policy to enforce compliance to a Federal Law, why are there so many students who are unaware of the application copyright laws in educational settings? These are not easy questions to answer.

No Levels Of Literacy About Fair Use Guidelines

One possible answer to the question about copyright awareness is that teachers do not understand there are fair use exceptions made to Copyright Law for educators and students. In environments where resources are thin or non-existent, the urge to use materials regardless of unforeseeable consequences can be high. This is not to imply that educators are not moral about what they do; instead, it could easily be said this is a group of people who are working against many obstacles (economic as well as political) to provide adequate and timely information to students. Anyone who has ever been a teacher can recall finding just "the perfect" resource to use in a class and not being able to purchase enough copies for use by students because there was no budget for extras. The option usually is to have multiple students share one or few resources. In places with high numbers of students, this can be problematic in the flow of instruction. How many class periods should a student wait until they have access to the information or resource for learning? In an ideal world, none. The materials should be available when needed without the need to replicate illegal additional sets.

Frustration About Lack Of Available Materials For Use In Classrooms

When the above mentioned entry level students into teacher education were first introduced to the idea of the fair use exclusions, they either expressed relief at having a way to use materials or confusion about the materials provided to them by school districts or hostility at a limitation to their ability to teach with current or appropriate materials they did not believe would be provided in a timely manner to them or their students. This is a question that is not easy to solve. Certainly under the principle of copyright protection, the creator of products deserves to control the monetary rewards of their efforts. The irony is that many of the authors of books or articles actually loose control over the dissemination of their ideas. They cannot give permission to a teacher to use those materials, but instead, must refer the teacher or student requesting permission to use copyright compliance personnel in large corporations. There should be a streamlined process outlined and readily available to exactly the purpose of requesting permission to use materials. Most teachers and even fewer students know how to obtain permission for use of materials. The assumption being made about using materials without permission is if "they" don't know, it won't hurt anyone.

Solutions

Awareness Of The Economic Benefits Of Copyright Compliance

It is extremely important to make a connection between an economy based on information and the financial benefits of the copyright process. Giving the response that copyright is the law of the land does not inspire compliance. There should also be motivating reasons for compliance. Frequently in discussions with teachers and students, they comment on how much money the copyright holder must be making compared to the end users' income base. What is frequently not mentioned is the economic base created by the business of replication of copyrighted materials. It is easy to loose site of the idea of people other than the copyright holder or Big Businesses benefiting from copyright compliance. The idea of people depending on the sale of copyrighted materials for the continuation of their jobs creates support of copyright benefits. The growth of the economic structure of an information rich society cannot afford societal ignorance of what factors create that structure.

Awareness Of Fair Use Protections For Educators

The umbrella of fair use provides benefits for educators and students. The restrictions for time are more restrictive for teachers who are displaying or using copyrighted materials than for students, but both may use copyrighted materials, in proper proportions, to extend their ability to teach and to learn and for proof of their talents. This is the intended focus of the educational system. The ability to access ideas is not limited. Ideas cannot be copyrighted. The uniqueness of expression of an idea is what allows the process of continual, intellectual, creative renewal to occur and thrive.

If we are indeed in a culture based on the cumulative nature of information as well as the expression of new ideas arising from problem-solving processes, the body of professional educators should not be reusing fixed ideas without renewal. Understanding of knowledge evolves and within that context of understanding, people change in their perceptions and processes of applying knowledge. Fair use not only protects the accrual of copyright benefit to rightful owners but it also provides protection to the intellectual integrity of this nation through the promotion of change. Specifically, the fair use guidelines promote appropriate usage of multimedia presentations, rich with knowledge and expression of ideas, for two years. Then the same fair use guidelines promote the idea of renewal and change (Fair Use Guidelines, Section 4, time, portion, copying and distribution). According to the American Library Association: (1995, Fair Use In The Electronic Age section. ¶)

> The genius of United States copyright law is that, in conformance with its constitutional foundation, it balances the intellectual property interests of authors, publishers and copyright owners with society's need for the free exchange of ideas. Taken together, fair use and other public rights to utilize copyrighted works, as confirmed in the Copyright Act of 1976, constitute indispensable legal doctrines for promoting the dissemination of knowledge, while ensuring authors, publishers and copyright owners appropriate protection of their creative works and economic investments. [5]

A Reflection On Application Of Copyright And Fair Use In Actual Settings

Although multiple reasons for compliance with copyright laws and fair use guidelines can be made, the final resolution will ultimately be determined by availability of resources. The pressure of education is to provide learning experiences. The pressure of copyright is to provide income. This issue will continue to create conflicts. The resulting balance must be a resolve for those groups depending on the flow of information for educational purposed to find solutions for the future. If this balance is allowed to decay or become lost, there will be a huge loss in personal educational freedoms.

Issues Unresolved

Protection Of Educator's Intellectual Properties And Distribution Of Materials To Students.

Most educators in K-12 settings develop materials specific for their personal needs. The intellectual properties of those materials are seldom promoted as a topic of discussion at local PTA meetings. However, the reality is those materials are indeed copyrightable under the law. Fortunately, many if not most educators tend to share those intellectual properties with their peers. Large databases of lesson plans are appearing on the Internet for access by prelicensed educators as well as licensed educators. There may be no other profession that so freely gives of its intellectual properties. It would be interesting to see the results if drug conglomerates provided web sites with lists of formulas for effective medications. There is no argument under the law that lesson plans are unique and tangible expressions of ideas that belong to their creators. If anything, there is a cultural expectation that teachers will provide lesson plans and handouts free for all to use.

Availability Of Quality Materials That Are Free To Educators And Students

There exists an enormous need for free, quality materials for non-profit educational groups. Many free resources are also ones that are not in high demand because they are outdated or not professional prepared. Is there a need for a national bureaucracy dedicated to creation of free, useful, quality materials for all grade levels? Although the government funds a national printing office for replication of reports and other printed materials created by government entities, those materials are not generally geared toward traditional educational settings. Free documents geared for professional applications in graduate schools seldom benefit the 1st grade teacher trying to teach about the balance of nature.

The reluctance of the same federal agencies promoting educational reform to also promote affordable educational materials is not unusual. If the idea of educational reform is to truly become effective, then the idea of affordable, useful, quality materials must also emerge. Why can't there be a way to purchase the same textbooks for educational purposes so that copyright owners win, publishers win, and most importantly, teachers and students win.

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[2] Ibid.
[3] Ibid.
[4] Ibid.
[5] American Library Association. (1995). Retrieved Sept 25, 2003 from http://arl.cni.org/scomm/copyright/uses.html

Making a Case for Object-Oriented Instructional Design: A Case-based Learning System on Winter Weather Forecasting

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Abstract

The frequently cited promise of learning object strategies for instructional design assumes that finely grained instructional content will be frequently borrowed from and used by a wide community to create customized instruction. But this promise is still somewhat problematic for many reasons, and it may be some time before we know whether scalability benefits will emerge. However, the use of object-oriented design strategies to facilitate problem- and case-based learning curricula offers planned (as opposed to speculative) reuse of learning objects, the possibility of distributed development efforts, and the potential to create rich learning environments with a variety of resources. This paper describes the design of an online Winter Weather Forecasting curriculum that employs object-oriented instructional design to offer content-rich, interactive case studies.

Concerns about Object-Oriented ID

The use of learning object strategies offers both many promises and many potential problems for the future of education and training (Parrish, in press). Much of the touted promise centers on the assumption that efficiencies will be created as large repositories of finely grained learning objects are frequently borrowed from and used to create custom instruction. This, of course, presupposes that large numbers of content developers will be willing to take the trouble to share their content and incorporate the required metadata to make it compatible with these digital libraries. In the end, there may be limits to how much borrowing and sharing people are willing to do that may limit the use and usefulness of digital libraries. For some, instructional content is also intellectual property to be protected. Proper attribution preserved the metadata and embedded in the content may help, but there may remain a concern that content quality can be reduced as it is adapted. More importantly, sharing learning objects that can be catalogued and stored in large repositories requires work to create useful and detailed metadata. Many potential sharers may be put off by the additional effort, or do a less than adequate job. Finally, for many educators, instruction is an expressive activity, and the desire to produce original materials may be stronger than the value of efficiency.

The promises attributed to learning object strategies also assume that good, coherent instruction can result from using these disparate learning objects to build lessons, that this process will save time, and that a learning object approach does not diminish the quality of instruction for the sake of reusability. But there may be constraints on a designer's ability to create meaningful learning experiences using learning objects provided by multiple, independent developers. For example, the value of providing a rich context for instructional content is a proposition of many theories of learning and instruction, including those focused on learner motivation (Keller, 1983), and those positing the situated nature of knowledge (Lave & Wenger, 1991). Because one goal in learning object design is to remove context for the sake of reusability, instructional designers are tasked with (a) avoiding an inclination to embed context, (b) creating strategies for including context that does not "bleed" into the learning objects themselves during their original implementation, and (c) creating an alternative context during reuse. Many of the benefits of learning objects assume little instructor intervention, but as the above shows, this is far from the truth.

A Case-based Approach

While questions remain about the viability of learning object strategies, some applications show immediate and great promise that does not rely on scalability beyond a focused development project. The use of object-oriented design strategies to facilitate problem- and case-based learning curricula offers planned (as opposed to speculative) reuse of objects, a distributed development effort, and the potential to create rich and varied learning environments with a wide range of resources. Similar to object-oriented instructional systems described by previous authors (Schank & Cleary, 1995; Bannan-Ritland, Dabbagh, & Murphy, 2002; Orrill, 2002), the COMET® Program is employing a learning object approach in creating a case-based learning curriculum for weather forecasters

The COMET® Program, in association with the Meteorological Service of Canada and the National Weather Service (U.S.), is developing a case-based, professional development curriculum for weather forecasters titled, *Mesoscale Aspects of Wiinter Weather Forecasting*. Case-based reasoning (Jonassen & Hernandez-Serrano, 2002; Kolodner & Guzdial, 2000) has long been recognized in the practice of weather forecasters, who build expertise not only by gaining a deeper understanding of meteorological science, but through case experiences where situational constraints strongly influence how they apply general and local knowledge. Multiple realistic cases that ground scientific knowledge are an essential aspect of initial training for any forecaster, and are equally important in professional development that updates scientific knowledge. Case-based learning approaches provide a natural environment in which to exploit object-oriented ID strategies by maintaining strong context without excessive design effort.

Each of the planned 15-18 Web-based modules will be based on a case representing a particular winter weather forecast challenge. Student performance in each case is supported by short lessons (developed as reusable learning objects) that treat knowledge and skills required for good decision making during such cases. Lessons treat topics such as the conceptual models and physical processes of winter weather phenomena, cloud microphysics, forecasting tools, data analysis, climatology, and public forecast impacts as they relate to winter weather forecasting.

Each case begins with a Case Challenge that places the learner in the role of a forecaster in a particular office, with the goal of forecasting specific aspects of a winter weather event, such as the timing, location, or approximate accumulation of snowfall. Resources for the Case Challenge include a rich dataset (including satellite and radar imagery, numerical guidance, and other data products provided incrementally as the case unfolds), relevant supporting topics (the learning objects described above), and also may include advice from experts or experienced forecasters. The Case Challenge is built upon several interactions that replicate typical decisions made by forecasters as they develop a forecast, such as the choice of appropriate data products to analyze, judgments about the accuracy of numerical model guidance, or the diagnosis of underlying processes revealed in the data. The choices the learner makes during the Case Challenge may at times trigger feedback that recommends particular case resources that would have helped the learner in making better choices.

Following the Case Challenge is the Case Analysis, which explores the case in a systematic way and provides explanation for what occurred. Like the Case Challenge, this section of the module also calls upon the supporting topics (learning objects) to enrich the discussion of the case at hand. Each module culminates with a short set of questions testing knowledge of the event's main characteristics and understanding of key meteorological and forecasting concepts underlying the case.

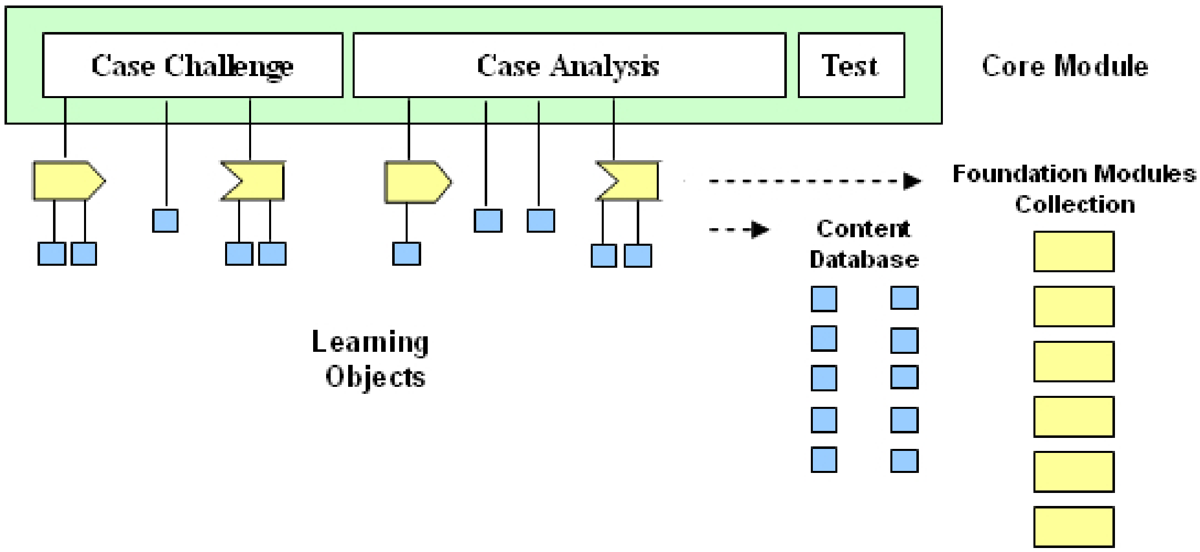
Benefits to Object-orientation

The object-oriented approach to creating and providing the instructional resources for the case will facilitate several things:

- distributed development responsibility, allowing content developers at multiple locations to create the instructional materials. Since The COMET Program works with national and international experts, as well as other training groups, this benefit is large
- flexible learning options for users, allowing more experienced and knowledgeable forecasters easily to skip portions of content with which they are already familiar. Learners may also choose to review by revisiting only the collected learning objects or the case summaries
- increasingly efficient development, through the probable reuse of content in multiple cases (especially later in the effort). Many of the topics (for example, the microphysics of snow formation) will be of concern in nearly all the potential cases that will be chosen

In addition, as development proceeds, learning objects can be collected within direct instructional "Foundation Modules" and within content databases that some learners may prefer due to their limited time for on-the-job training, and for more rapid reference and performance support. (See Figure 1 below.) Of course, learning objects will also be submitted to appropriate digital libraries such as the Digital Library of Earth Science Education (DLESE) (www.dlese.org) and the National Science Digital Library (NSDL) (www.nsdl.org).

Figure 1. Module and Learning Object Relationships



Development Plans

The first module in this curriculum, *Ocean Effect Snow: New England Snow Storm, 14 January 1999*, was published in March 2003 (http://meted.ucar.edu/norlat/snow/ocean_effect_case/index.htm). By spring of 2004, we expect to have 3 additional modules completed and to have gathered feedback from initial users of the products. (Feedback so far is limited due to the unseasonable timing of the spring release.) The COMET Program is hopeful that this curriculum development effort can serve as a model for similar efforts, and indeed it has already been suggested as a potential model by other meteorological training organizations.

Our second project in the effort is being done in collaboration with the UK Met Office College and the European meteorological training consortium, EuMetCAL. The Met Office is adopting these case-based and object-oriented strategies in our joint effort to create training on how to forecast Polar Low events. The project is being carried out by a distributed project team, and will include both a North American and European case challenge, accompanied by a set of shared and co-developed supporting topics as learning objects. Even though the final products used in the U.S. and European will be in different formats (Flash-based in the U.S. and XML/HTML-based in Europe), the same content drafts will form the basis for both, diverging only in the final phases of development.

The object orientation of our design is what makes such collaboration and division of labor possible. This strategy will leverage our resources to better serve our broad community of users, which also includes military forecasters, university departments of meteorology, and other international weather services. Collaborative projects such as the one with the UK Met Office and EuMetCal will increase the development capacity of all collaborating groups, and will also broaden to the repertoire of cases and techniques for learners.

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Dropping your anchors: Implications for learning anchors in traditional classrooms

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The increased access to technologies in schools has opened avenues to explore non-traditional styles of teaching and learning. Educational theorists and researchers have long been calling for learner-centered instruction that situates learners in activities that allow them to explore concepts and construct understanding. However, as constructivist theorists and researchers continue to show the benefits of situating learning in meaningful tasks, many barriers still prevent the use of technology-enhanced authentic activities in classrooms (Shaw, 2003; ISTE, 2002). This paper aims to analyze the underlying theories of authentic learning and propose methods to support classroom teachers with the design, implementation and assessment of authentic activities.

Technology In Schools

As computers and other technological devices arrive in schools they continue to be an underused resource to anchor learning in authentic learning environments. The latest reports from Market Data Retrieval (2002) cite that the ratio between students and instructional computers is an all-time low of 3.8 to 1. Further, the report states that there are 4.9 students to each Internet-connected computer. Becker and Ravitz (2001) surveyed secondary teachers and found that less than 25 percent of them were using computers on a weekly basis to enhance instruction. In most cases the technology is used in drill and practice settings, rather than promoting process or higher-order thinking skills (Becker, 2001; Shaw, 2003).

Technology's potency to anchor learning in authentic environments has been long running. Bransford et al. (1990) contended that video discs and other technologies can be employed to anchor instruction in authentic tasks. Hannafin (1992) advocated using electronic tools and resources in open-ended learning environments (*OELEs)* to allow students to investigate real-life problems. Bransford and his colleagues in the Cognition and Technology Group at Vanderbilt (CTGV) (1992) provided a significant bridge from theory to practice with the *Jasper* series, a set of videodiscs that anchors mathematical problem solving in authentic narratives. Students watched the videodisc, then identified and solve problems that were embedded in the story. The *Jasper* series was the first of many technology-rich activities that attempt to situate learning in authentic contexts. CTGV's endeavor to promote authenticity via technology has been promoted by other researchers (see Griesser, 2001; Herrington & Oliver, 1999; Shyu, 2000).

Those studies continue to support the effectiveness of student learning in technology-enhanced authentic learning environments (CTGV, 1992; Grieser, 2001; Shyu, 2000;). Such an onslaught of research, however, begs the questions: what theories are underpinning the notion of authentic activities, and if authentic learning is such an effective method of instruction, why isn't everyone using it?

Theories of Authenticity

The term authenticity has become commonplace in education, yet its definition remains obscure and undefined (Barab, Squire, & Dueber, 2000). Authentic learning environments, traditionally, describe structured activities that have meaningful context (Radinsky et al., 1998). The term "meaningful context", however, is not the same for all people. For example, while investigating the migrating patterns of buffalo may be authentic for children in the midwest, that activity lacks meaning for students who live in a fishing village on the coast of the Atlantic Ocean. Authenticity lies in the eyes of the beholder, since an experience is authentic if and only if the learner can derive meaning from the experience (Barab & Duffy, 2000).

Authentic learning is akin to Dewey's (1910/1978)'s notion of learning through experience, as well as Vygotsky's theory of social learning (1987). Dewey cited the importance of learning through various experiences in life that the learner can participate in. Vygotsky (1987), meanwhile, contends that schooling should introduce learners into various communities of practitioners. In science education courses, Vygotsky would advocate participation in experiences of scientific investigation and inquiry that resemble the activities that practitioners engage in.

When schooling is based on authentic tasks, students become more responsibility for their learning, and actively participate in the collection and analysis of information, as they seek ways to solve specific problems. Most activities bridge many disciplines, bridging numerous content areas, thus enabling them to master content more effectively (Barab and Linda, 2000; Brown, Collins and Duguid, 1989).

Paradoxically, education primarily remains the home of abstract and decontextualized instruction. Brown et al. (1989) concluded that school activities lack value in the real-world, since formal schooling has very little transfer to real-world practice and they contended (p. 36) that "success within school often has little bearing on performance elsewhere." Recent studies (Becker, 2001; Greisser, 2001; Shaw, 2003; Shyu, 2000) have confirmed that although instruction has become more engaging for learners, classrooms still remain a place where students engage primarily in drill and practice activities, providing minimal transfer to real-world settings. In order to transfer to real-world contexts to occur, instruction should be situated in contexts that are as life-like as possible.

Components of Authentic Learning Environments

Four primary components emerge from the body of literature concerning learning that is situated in authentic environments. They are cited in the table below:

Component	Summary	Literature
Meaningful Tasks	Learners should participate in tasks that they can derive meaning and purpose from. Tasks should maintain the interest of students and encourage the transfer of knowledge from the learning environment to other situations.	Bransford et al. (1990), Brown et. al (1989), Dodge (2003), Moore et. al (1994), Scardamalia & Bereiter (1996), Shaw (2003).
Open-Ended Environment	Activities should be open-ended and be able to be solved in multiple ways. The activity should emphasize the problem solving process, rather than encouraging the student to simply find the correct answer.	Barab (2000), Bransford et al. (1990), Greeno (1998), Moore et. al (1994)
Scaffolds to support learning	Scaffolds should be available to the learner during the learning process. Examples could include a teacher facilitating the problem solving process, the modeling of an expert, or just-in-time resources.	Herrington and Oliver (1999), Oliver and Hannafin (2001), Shaw (2003), Vygotsky (1987).
Opportunities to reflect	Reflective thinking should encourage learners to think about the problem-solving process and reason through other points of view. Reflection increases the likelihood of knowledge transfer to similar situations.	Brush (2003), Bruning (1999), Dodge (2003), Greisser (2001), Herrington and Oliver (1999).

Examples of Authentic Learning Environments

While the idea of authentic learning is promising, teachers are unlikely to employ such activities without concrete examples. Below are two examples, one for seventh grade mathematics and one for a high school history class.

Seventh grade mathematics: You receive a credit card in the mail. The credit card has a minimum payment of $25 a month and a 10% annual interest rate. You want to buy a $600 entertainment system. If you earn $50 a month babysitting, examine your options of paying off the bill? Which option is the cheapest? If you only made $50 a month babysitting, how would the price you paid for the entertainment system change?

First, the task is meaningful, as students must form an understanding of credit, debt and interest. The activity is open-ended with many ways to solve this problem. Activities such as this lend themselves to employing a spreadsheet to provide a visual representation of the data, as well as explore various variables that affect the problem, such as how much of the debt is paid each month. The teacher can serve as a scaffold, providing support on identifying the problem, choosing an approach to the problem and key questions to focus on throughout the activity. The use of a spreadsheet or table can also scaffold learning, by providing a display of data that the learner can manipulate in order to find a solution. This activity also has the potential to be reflective as well. A spreadsheet or calculator will allow students to collect data for various situations, such as 1) paying off the debt as soon as possible, 2) paying slightly more than the minimum payment or 3) paying only the minimum payment. Comparing the various scenarios enables the learner to choose which option is the best, and allows generalizations to drawn from that information.

While authentic learning activities are pretty realistic in mathematics, other life-like situations can be created for other subjects.

High School government: *You are the campaign manager for Douglas Dooright, a candidate for U.S. President. The Presidential Election will be on November 6th. Douglas will by flying around the country making his final bid for votes from October 29-November 5. If he can only make three speeches a day and has only $3,000 to spend on airfare, what will his itemized travel budget look like? Explain why you chose to travel to each location.*

The task described is life-like and meaningful, as the learner takes on the role of a campaign manager, planning the speech schedule for a presidential candidate. This activity builds on skills such as scheduling, money management, and comparing travel fares, which are all meaningful tasks to high school age students. This activity is extremely open-ended, allowing students to decide when traveling occurs, where they will travel and which airfare to use. Once again, the teacher has the potential to serve as a scaffold, as students interpret the problem, choose their approach, and make decisions during their activity. Technology, mainly the World Wide Web, also scaffolds learning by providing just-in-time information on electoral votes, key locations and travel fares whenever the students need it. While, the immediate access to information helps the student in the activity, it has the potential to be a hindrance. Oliver and Hannafin (1999) cited dilemmas with students with managing information in OELE's as learners became inundated with data. This problem can be lessened if the learner participates in reflection and focuses on the problem solving process. Each student is going to have a different travel schedule, since there are numerous cities and numerous airline flights each day. The learning that occurs is not simply how to design a travel itinerary, but how to engage in data-based decision making and support their choices in a logical manner.

Technology's Role

It is obvious that technology serves as a potent resource in authentic activities. In the first example, the use of a spreadsheet allows students to visual represent their investigation in a chart. By using a spreadsheet, students can set up the chart using formulas and investigate scenarios based on how much they pay each month. A calculator could also be used instead of a spreadsheet. But, while a calculator facilitates the calculation of interest and payment, it does not provide a dynamic representation in the form of a chart like a spreadsheet. Without the use of a spreadsheet the activity could be completed, but becomes more focused on performing calculations, rather than representing a problem and making data-based decisions.

In the second activity, the Internet and airfare websites such as www.orbitz.com students have access to airfares quickly. A spreadsheet could then be used to store their records and keep a running tally of their travel budget. The process of completing this activity resembles a traditional webquest (Dodge, 2003), in which students use the Internet to find information and apply it to solve a problem.

In both activities, access to technology is essential. Students must not only be able to get to the technology, but also must have the requisite knowledge to complete the activities (NRC, 2002). In both activities, the requisite knowledge includes being able to set up and manipulate a spreadsheet. The second activity also requires the student to know how to search the Internet for information.

Technology skills are now a part of curricula nationwide, as students learn word processing skills, how to work with spreadsheets, and how to create products such as presentations and webpages (Market Data Retrieval, 2002; Sargent, 2003). Employing technology-rich authentic activities supports current research (NRC, 2002; Market Data Retrieval, 2002) that students should learn these technologies by using them in life-like contexts.

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Put the Learner First: Cognitive Theories in Instructional Design

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Introduction

Instructional design models encompass a wide gamut of theories and applications in education and training environments. Gustafson and Branch (2002) described a taxonomy with three specific purposes for the development of instruction. The three categories encompass 1) development of instruction for individual classrooms, 2) product development for implementation for users other than the developers and 3) more complex instructional systems instructed directed at an organization's problems.

Classroom instructional design models are of great interest to those who see their role as a teacher to students. Users of these models include K-12 teachers, university faculty and some training programs in business and industry (Gustafson and Branch, 2002). The Morrison, Ross and Kemp model serves as a framework to develop effective classroom instruction for instructional designers. The model originated with Kemp's original design in 1971 and has evolved in the past 30 years into its present form.

Conceptual Basis

Morrison, Ross and Kemp's model is holistic in nature. It is based on the concepts that instruction should be learner-centered, engaging and designed specifically to meet the characteristics and needs of the learner. Further, the model employs the concept that the conditions of the learning environment are significant to the effectiveness of instruction.

As the model evolved, Morrison became the lead author, but has maintained the same learner-centered concepts that Kemp used in its original development (Gustafson and Branch, 2002). Morrison has significant background in training and sees the benefits of cognitive based approaches. Morrison (personal communication, January 30, 2003) explained, "both Steve Ross and I were trained with a heavy emphasis on Bruner's work, which lent itself to the orientation of this model. In addition, my experience in business and industry convinced me that content-oriented models were not very effective."

Theoretical

Morrison, Ross and Kemp adhere to the belief that instruction and instructional development should be learner-focused. Bruner's cognitive-based theories can be attributed to the foundation and evolution of this model. Bruner (1973) posits that instruction should be concerned with three main issues. First, instruction should be based on the experiences and contexts that make the student willing and able to learn, known as readiness. Second, instruction should be structured so that the learner can effectively grasp the content. Finally, instruction should be designed to facilitate the extrapolation and application of knowledge, allowing the learner to construct their own meaning.

Morrison, Ross and Kemp (2001, p. 4) advocate asking a series of questions during the development process. As illustrated in the figure below: four of the questions coincide with Bruner's theories of cognitive-based instruction.

Figure 1:

Morrison, Ross and Kemp's essential questions	**Bruner's theories**
1) What level of readiness do individual students need for accomplishing the objectives?	Instruction should account for the learner's experiences and readiness.
2) What instructional strategies are most appropriate in terms of objectives and learner characteristics?	
3) What media or other resources are most suitable for instruction?	Instruction should be structured so that the learner can effectively grasp the concept.
4) What support is needed for successful learning?	

The other two questions address the assessment of instruction and the development process: 5) How is achievement of objectives determined? 6) What revisions are necessary if a tryout of a program does not match expectations?

The theories of cognitive psychologists advocate instruction to be learner-centered and developed with the learner's characteristics in mind. The Morrison, Ross and Kemp model applies cognitive concepts and theories to the development of instruction by keeping the process focused on the characteristics and needs of the learners.

Operational

The Morrison, Ross and Kemp model expresses their views that Instructional Development is a cyclical, systematic process with revision as a continuous activity (Gustafson and Branch, 2002). The developer of instruction, according to Morrison, Ross and Kemp, should attend to nine main elements. These elements are interdependent and can be completed as appropriate (Morrison, personal communication, January 30, 2003; Gustafson and Branch, 2002).

Morrison posits that developers starting afresh should first define the instructional problem. While some developers contend that development can begin with the task analysis, Morrison (2003) claims that, "a task analysis can not be done without knowing focus of the instruction (i.e., a goal analysis). The problem must be defined before other tasks, if the designer is starting from scratch."

The current model varies slightly from the operational nature of Kemp's original model. In 1971, Kemp established a linear sequence for developing effective instruction. The model changed into an oval pattern (see Appendix A), which takes away any notion of a linear sequence (Kemp, Morrison and Ross, 2001). Kemp, Morrison and Ross (2001) wanted to symbolize the non-linear model of instructional development, allowing individuals have the flexibility to proceed through the process in their own preferred way.

The one aspect that has been consistent throughout the evolution of this model has been the significance of revision in the process of instructional development. Kemp's original model called for formative revision to occur after each step in the process. In the current model, formative evaluation and revision are integrated into every step of the instructional development process. In addition to formative evaluation, the current model calls for summative evaluation at the end of the development process. Further, confirmative evaluation is recommended to occur months after completion to evaluate both the instruction and the materials that were developed.

Analysis

In comparison to the ADDIE model, Morrison, Ross and Kemp's model has a multitude of analytical components. Analysis occurs during the first three elements of the model. In order for the developer to define the instructional problem, discover the characteristics of the learner, and conduct a task analysis all require the developer to use a similar process to the Analysis stage of the ADDIE model.

Appendix B shows McGriff's realignment of Morrison, Ross and Kemp's model to fit into the components of the ADDIE model. The model's learner-centered nature requires the developer to thoroughly understand the learner before instruction is developed. The following analyses are incorporated into the model: needs analysis, learner analysis, analysis of instructional strategies, task analysis, goal analysis and problem analysis (Kemp, Morrison and Ross, 2001). In the model, the analysis component is the most thorough (Morrison, personal communication, 2003).

Design

Two of the nine elements in Morrison, Ross and Kemp's model coincide with the design process of the ADDIE model. Both the instructional objectives and the sequence of content are designed in Morrison, Ross and Kemp's model. Instructional objectives should be written in terms of the learner and cover the three primary domains (Kemp, Morrison and Ross, 2001).

The focus of instructional design should be the cognitive domain, which includes objectives dealing with information, knowledge or other intellectual aspects of learning. Coinciding with Robert Gagne's work, Morrison, Ross and Kemp contend that instruction should extend to the higher levels of the cognitive domain, such as the more advanced stages of Bloom's taxonomy. Instruction should also account for the psychomotor domain, which includes skills associated with the use of skeletal muscles.
Finally, instructional objectives should be based include the affective domain, an area encompassing attitudes, values and emotions.

Development

While one would expect an instructional development model to be heavy-laden with phases of development, Morrison, Ross and Kemp's model is contrary to that. The model incorporates steps for the development of instructional strategies and the design of the message. The learner-centered nature of the model establishes a standard for instructional strategies to include engaging activities that allow the learner to take responsibility in constructing their own knowledge.

The design of the message must account for the characteristics of the learner and incorporate media that effectively present the content during instruction. Morrison, Ross and Kemp's use of a cognitive-based learner-centered model requires the media to be effectively integrated in the curriculum in such a way to make learning an active, constructive process.

Implementation

The instructional delivery and the use of evaluation instruments fall into the Implementation phase of Morrison, Ross and Kemp's model. The essential point in the implementation phase of the model is the need for revision. While formative evaluation has occurred during each part of the instructional development process, the largest impact of formative evaluation occurs just before the implementation of instruction (Morrison, Ross and Kemp, 2001).

The implementation of evaluation is also a critical part of the model. However, Morrison recognizes problems with this element of the instructional design model for industry training. Morrison (personal communication, January 30, 2003) contends that, "testing is not always welcome or well-suited for the industry environment. Often times, it is left out of the training altogether."

Evaluation

As mentioned previously, Morrison, Ross and Kemp fully endorse the constant use of formative evaluations to monitor the process of developing effective instruction. Three means of evaluation are used in the model. Formative evaluation occurs throughout the instructional development process, and provides the designer with easy accessibility to making changes as they are needed (Morrison, Ross and Kemp, 2001).

Summative evaluations occur at the end of the instructional development process and attempt to evaluate the development of instruction on a larger scale. Further, the model uses confirmative evaluation a long-term after the implementation of instruction. Confirmative evaluation analyzes both the instruction and the materials that were used during instruction (Morrison, Ross and Kemp, 2001).

Orientation

This holistic model is comprehensive and has both prescriptive and descriptive orientations. Edmonds, Branch and Mukherjee (1994) explained that "descriptive models outline a given learning environment and imply how the variables of interest will be affected in the environment based on practical experiences of instruction and learning (p.60)." This model is descriptive since it bases every factor on the practical experiences of learning and the specific needs of the learner. Every analytical component of the model lends itself to its descriptive nature.

Paradoxically, prescriptive models focus on how learning environments can be manipulated in order to bring about desired outcomes (Edmonds et al., 1994). The elements of sequencing the content, developing instructional strategies, designing the message and developing instructional and evaluation materials contribute to the model's prescriptive attributes.

Knowledge Structure

Morrison, Ross and Kemp's model resembles traditional declarative models. By developing instruction from the vantage point of the learner the learner accounts for each learner's characteristics and learning needs (Gustafson and Branch, 2002). Their first essential question is "what level of readiness do individual students need for accomplishing the objectives." The essential questions and elements of the model frame a developed product that is much more focused on learner-centered instruction that is catered to the individual needs of the students.

Expertise Level

Morrison, Ross and Kemp's model can be employed successfully by the most novice of designers. The nine elements are clearly laid out and establish a framework that allows designers to gain information about the instructional problem and the learner prior to designing instruction. The model's flexibility is a strength, with its interdependent elements that permit users to operate where modifications are needed (Gustafson and Branch, 2002).

The pre-established essential questions and algorithmic steps and procedures are characteristics of models that are appropriate for novice instructional designers (Edmunds et al, 1994). As a novice designer in the business and industry sector, the model systematically walks the user through each individual step. The narrative (in Morrison, Ross and Kemp, 2001) provides the theoretical framework and implications for use, but is not necessary for an instructor to design effective instructional units.

Structure

A designer starting anew would begin the design process by identifying the instructional problem prior to completing any other steps. Due to the model's dependence on the instructional problem and the characteristics of the learner, the model can be categorized as a hard-systems instructional design model.

Gustafson and Branch (2002) describe hard systems as models aiming for the efficient attainment of goals. Hard systems advocate goal seeking as an appropriate model of human behavior. Morrison, Ross and Kemp's model focuses on helping the learner to master the established objectives, coinciding with the notion of attaining goals in instruction.

Context

Gustafson and Branch (2002) classify the Morrison, Ross and Kemp model as a classroom-oriented model that is user-friendly to both K-12, business and industry instructors. Morrison (personal communication, January 30, 2003) claims, “the focus is mainly on training for business and industry, but is unique since most training for business is content-centered, rather than being learner-centered.” Morrison, Ross and Kemp (2001) explain in Chapter 1 that K-12 educators cannot afford the time to thoroughly engage in the instructional design process, which led them to framing this model towards a business context.

Level

Morrison, Ross and Kemp's model provides a framework for designing a lesson or unit's worth of training. The model's thorough analysis of the learner and its learner-centered nature prevent this model from being used efficiently on scales, such as institutional, modular or curriculum. Unit-level instructional design determines the specific topics and tasks that will be learned (Gustafson and Branch, 2002). Morrison, Ross and Kemp's emphasis on the events during instruction also allows a designer to plan a single lesson using the model.

Scholarly Opinion

Morrison, Ross and Kemp made a significant contribution to the field of instructional design with the development of their learner-centered model. Breaking away from the traditional content-based models, this framework employs a cognitive approach that designs instruction based on the characteristics and needs of the learner.

This model’s underlying concepts and theories are concise and effectively represented in its operational nature. The essential questions and elements of the model clearly employ Bruner’s theories of instruction and the concepts of creating learner-centered instruction based on the information collected during the analysis stage.

Morrison, Ross and Kemp’s model is heavy in its analytical components. The numerous types of analysis establish a strong background to help the designer develop instruction. But, are they all needed? “When I ask most students which step could be removed, most students answer the learner analysis,” Morrison wrote. “I do not think you can do away with this step, but it is probably the step receiving the least amount of attention in most cases.”

For a designer starting from the beginning of the design process, a thorough analysis is essential to effectively design instruction. However, the strength of this model is the interdependent elements, allowing designers to work on whichever elements are needed in any particular order. Hence, designers that have a strong sense of the learners and already have their instructional objectives defined, can begin the design process at a stage somewhere else in the design process. The oval shape of the model conveys the non-linear focus of instructional design.

Conclusion

Morrison, Ross and Kemp’s model provides a framework for developing instruction based on the learner’s instructional needs. The learner-centered concepts and cognitive theories of learning are clearly conveyed in the essential questions and elements of the model. Heavy-laden with analytical components and opportunities for constant revision, the model encompasses all aspects of instructional design and provides a sound backdrop for providing effective instruction.

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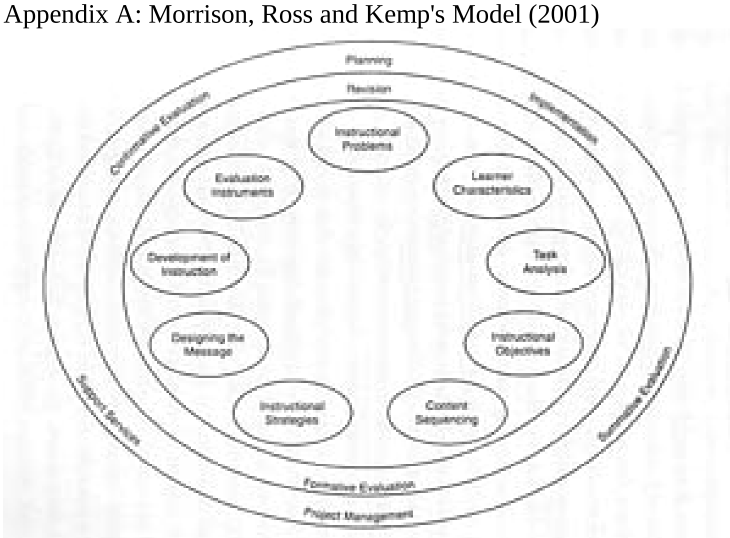
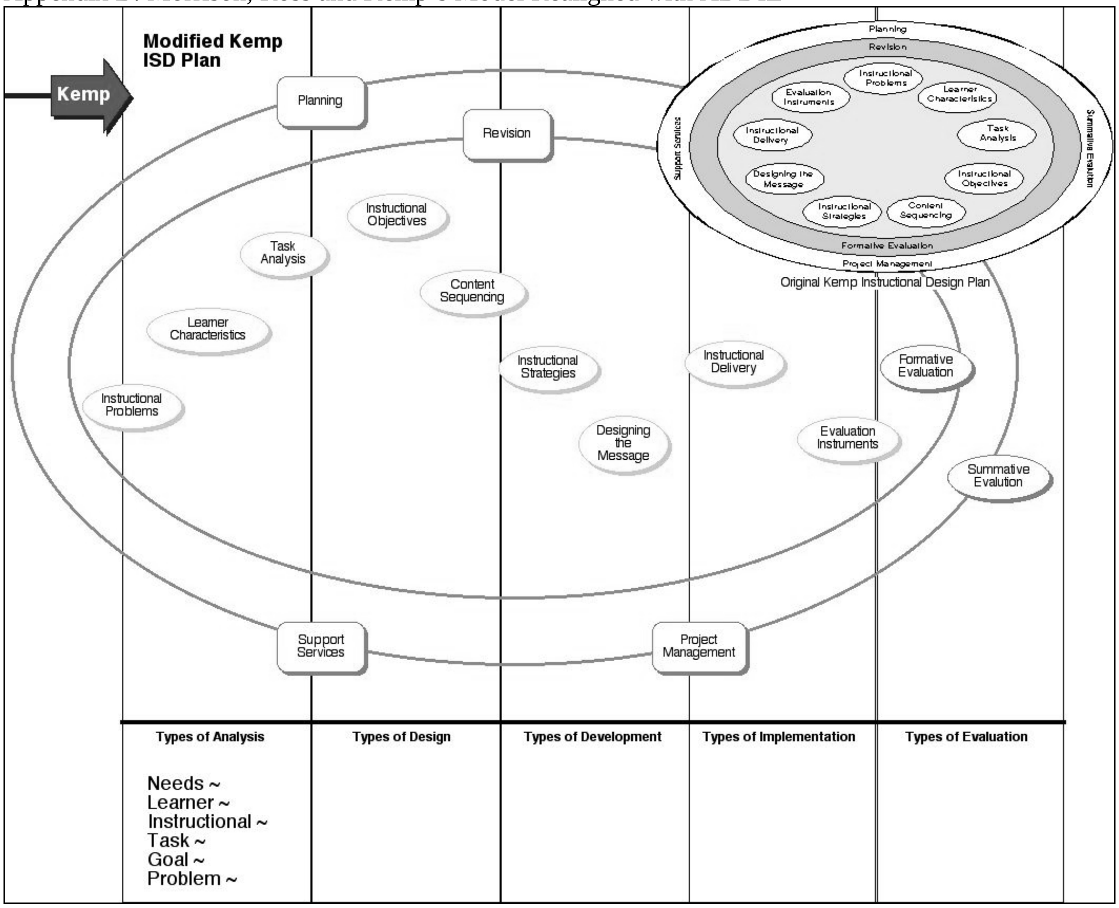
Appendix A: Morrison, Ross and Kemp's Model (2001)



In Gustafson, K.L., Branch, R.B. (2002).
Designing Effective Instruction, p. 26-29.
Syracuse, N.Y.: ERIC Publishing.

Appendix B: Morrison, Ross and Kemp's Model Realigned with ADDIE



By Steven McGriff
Available on-line at
http://www.personal.psu.edu/faculty/s/j/sjm256/portfolio/kbase/IDD/ISDModels.html#kemp

When Do Headings Improve Learning?
A Synthesis of Verbal Signals Research

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Abstract

Headings are commonly-used verbal signals that divide instructional text into smaller sections and prime the reader to the main ideas discussed in those sections. Writers of instructional text may incorporate headings into their work without realizing that it impacts the reader's ability to remember and process the information. In this review of literature, the effects of headings and other verbal signals on learning are explored. Of the studies reviewed, 15 are discussed and synthesized to form practical guidelines for instructional designers and educators. Among the findings, headings have been shown to promote recall of main ideas, knowledge of organizational structure, and problem-solving. However, even as signaling makes key topics more memorable, it can also inhibit recall and comprehension of subordinate information that is not signaled. These and other findings are presented and discussed.

Introduction

Headings represent one member of a large family of instructional variables called *signals*. Verbal signals include titles, introductions, overviews, headings, subheadings, transition statements, and summaries. Non-verbal typographical signals include bolding, italics, underlining, spacing, all-caps, font styles, font sizes, color text, and color highlighting. In instructional settings, verbal and non-verbal signals help learners navigate bodies of instructional text by providing structure, sequence, organization, and flow. Signals are used in the expectation that they make the relevant topics stand out in importance and thereby more memorable (Mautone & Mayer, 2001).

Headings, like other verbal signals, are "non-content words (that) make the semantic content and structure of expository paragraphs more explicit" (Mautone & Mayer, 2001: p. 377; See also Meyer, 1975). Headings divide the instructional text into smaller chunks, presumably making the information easier to encode. Readers can make use of headings as priming aids *before* reading (to help them skim the passage), as encoding aids *during* reading (to orient themselves to the text that follows), as retrieval aids *after* reading (to cue retrieval of a particular concept), and as search aids (to assist in locating specific information). Signals research has typically focused on the *encoding* effects of headings (Hartley & Trueman, 1985).

The encoding effects of headings have been shown to vary by a number of factors (Hartley & Trueman, 1985; Marcinkiewicz & Clariana, 1997). For example, Meyer, Brandt, and Bluth (1980) found that headings in text enhanced recall for poor readers but not for good readers. Conversely, Hartley and Trueman (1985) found that heading statements aided high-ability students most and low-ability students least. Such differences are common in headings research and are, in part, the result of differences in the treatment and assessment materials. However, these inconsistencies are also indicative of the subtle yet complex relationship that exists between the internal memory processes of encoding and retrieval and the perception of signals. The following is a review of the most pertinent studies.

Review of Literature

In the absence of headings and other signaling devices, which highlight the intended organizational structure of the reading passages, the reader utilizes a linear approach to reading the text. The ideas are stored in memory in the form of a serial list. The learner's processing of instructional content and his/her ability to recall or summarize key concepts is then highly dependent upon the content's serial positioning (Loman & Mayer, 1983), the textual elaboration of key points (Lorch, Lorch, & Inman, 1993), and the learner's prior knowledge of the subject matter (Lorch & Lorch, 1996b). These factors are "secondary indicators of importance of text topics" (Lorch,

Lorch, Ritchey, McGovern, & Coleman, 2001: p. 172). The presence of signals, however, can mitigate these factors, by focusing the learner's attention on the organizational structure of the content. Signaling devices enable the reader to use a structure strategy in which ideas are associated with higher-level topics within a broader organizational structure (Sanchez, Lorch, & Lorch, 2000). This should make it easier for readers to access ideas even when those ideas are not positioned at the beginning or end of the text. Signaling should improve recall of those ideas.

Despite this common sense hypothesis, Lorch and Lorch (1996b) note that some prior studies have failed to find significant signaling effects on total recall, i.e., the overall number of idea units recalled (Brooks, Dansereau, Spurlin, & Holley, 1983; Lorch et al., 1993; Meyer, 1975; Meyer & Rice, 1982). Even so, headings and other signaling devices have been shown to improve recall under certain conditions, for certain types of information, and for certain learners.

Do signaling effects vary by signal type?

Effects of headings, summaries, outlines, and underlined text on comprehension. In a study involving 432 Air Force basic trainees, Christensen and Stordahl (1955) examined the effects of signals on comprehension by presenting students with an outline, a summary, underlining, and/or paragraph headings. Using a factorial design, the researchers examined 35 different possible combinations of signals in comparison with a no signals control group ($n = 12$ per group). The pretest and posttests used consisted of multiple-choice test items. No significant interactions were uncovered for either pretest or posttest scores. Neither headings alone nor in combination with other signals had any appreciable impact on comprehension.

Effects of headings, previews, and connectors on topic recognition. In an effort to isolate the effects of headings, previews, and logical connectors on the retrieval of both inferential and detailed information, Spyrikakis and Standal (1987) examined all three signal types individually and in tandem with each other. The study involved 300 college students who each read one of four passages (topics were nitrates, corrosion, algae, and biomedical) of varying structure, depth, and length (ranging from 362 to 766 words). Each also completed one of four 10-item multiple choice tests measuring the ability to recognize both super-ordinate topics and subordinate information in the passages. The use of headings was found to be significantly beneficial with only one of the four passages (biomedical) and then only with regards to enhancing super-ordinate/inference comprehension, $F(1, 64) = 4.19$, $p < .05$ (p.291). The biomedical passage was the longest (600-766 words), the richest in terms of the number of topics (42 versus 36 for the next highest), and the most difficult in terms of grade level. This implies that headings are most useful for stimulating recognition of key points (super-ordinate topics) when the content is long, difficult, and complex. Nevertheless, Spyrikakis and Standal (1987) suggest that in this study, "the results are suspect due to a ceiling effect" (p. 291).

Effects of headings and outlines on free recall. Krug, George, Hannon, and Glover (1989) conducted a series of experiments testing the impact of presenting outlines (prefacing text) and headings (interspersed within the text) at encoding on students' free recall of prose. In the first experiment, involving 62 undergraduate Education majors and a 600-word essay containing 48 idea units, Krug et al. found that both headings and outlines improved recall equally well and that a combined headings/outline approach was the most effective, $F(3, 58) = 10.44$, $p < .01$. In their second experiment, Krug and his colleagues asked 56 students to read a 5500-word textbook chapter – in an effort to confirm the results of the first experiment in a more realistic classroom context – and again, headings and outlines improved recall equally well. The combined approach of headings with outlines was the most effective.

Effects of headings, overviews, and summaries on free recall. In a study designed in part to isolate the effects of different signaling devices, Lorch and Lorch (1995) tested the individual effects of headings, overviews, and summaries on free recall of main and subordinate topics. College students ($n = 274$) were given a 1,750-word passage that varied in terms of the presence or absence of the three signaling devices, with 31 of those participants receiving the headings passage. All three signaling devices improved recall of the 12 main topics (topic access), $F(1, 176) = 37.39$, $p < .05$, and conditional recall of subordinate topics, $F(1, 176) = 12.29$, $p < .05$ (p. 541). All three signals enhanced recall equally well. As a result, the results of all three signaling conditions were combined and analyzed with relation to the presence or absence of recall cues. Consistent with the encoding specificity hypothesis (Tulving & Thomson, 1973), Lorch and Lorch found that the presence of signals at encoding (in the passage) and recall cues (during the free recall task) significantly enhanced recall of both main topics and subordinate information. Interestingly, in the absence of recall cues, signaling only during encoding depressed recall scores, although these effects did not reach significance. The encoding specificity hypothesis predicts that context cues presented at encoding are most effective only when they are presented again at the time of retrieval. The findings in the Lorch and Lorch (1995) study suggest that signals operate in a similar manner as other context cues, enhancing recall the most when present at both encoding and retrieval.

Do signaling effects vary by ability level?

Signaling effects on cued recall by ability level. In a study measuring the impact of titles and paragraph headings on recall of prose text, Hartley, Kenely, Owen, and Trueman (1980) found that using titles and headings improved recall on 8 short-answer questions. The 175 second-graders who participated were blocked by ability level; asked to read a 400-word passage with (A) no title or headings, (B) with title but no headings, (C) with title and underlined passage headings written in the form of statements, or (D) with title and underlined passage headings written in the form of questions. Although they did not find significant recall differences between (C) headings worded as statements and (D) those worded as questions, Hartley et al. did find that conditions C and D combined – regardless of format – prompted significantly higher recall than conditions A and B combined, $F(3, 171) = 4.88$, $p < .01$. This suggests that headings, regardless of the format, improve the recall of prose. A significant interaction was also found between the use of headings and ability level. Low ability students benefited more from headings than high ability students, $F(6, 151) = 2.47$, $p < .05$ (p. 306).

Do signaling effects vary by item difficulty, familiarity, or prior knowledge?

Headings effects on retention and prior knowledge. Wilhite (1988) found a significant interaction between prior knowledge (1988) and retention. The study involved 116 college students who were asked to read an 8-section, 1,760-word passage with or without headings and answer 24 multiple-choice questions (8 low-level topic pretest items, 8 low-level topic posttest items, and 8 high-level posttest items). When means were adjusted with the prior knowledge covariate (pretest score), headings were shown to enhance retention of main-idea topics, $F(1, 111) = 7.51$, $p = .007$, but not for low-level detail (p. 220). Also, this effect only applied consistently to students with high prior knowledge, and not for the low prior knowledge ones. From these results, Wilhite concluded that:

> …part of the beneficial effect of headings derives from their tendency to activate relevant schemas in the reader during the encoding of the passage material…(and not) by promoting the interrelating of concepts (or by influencing) retrieval by serving as cues at the time of test for subjects with low preexisting knowledge. (p. 223)

In other words, with recognition tasks (e.g., multiple-choice tests), learners with higher prior knowledge are able to make use of headings because the headings activate already-existing schemas. This, in turn, helps these students remember the main ideas of a passage, but does not necessarily help them remember more of the subordinate information. Learners with low prior knowledge do not benefit from the headings.

Headings effects on multiple-choice test performance by item difficulty. In a study that examined the retrieval effects of headings in a 43-item multiple-choice test to demarcate topic sections, Marcinkiewicz and Clariana (1997) found that headings significantly improved test performance for low (*es* = 0.92) and medium (*es* = 0.44) difficulty items but had no effect for high difficulty items (*es* = 0.02). This study involved 143 mostly-male, adult workers. No expository prose passages or lists were used as lesson material. The results of this study varied from a similar one (Townsend, Moore, Tuck, & Wilton, 1990) in which no significant differences for headings were found. Marcinkiewicz and Clariana (1997) attribute the difference primarily to the fact that they accounted for item difficulty level and the previous study had not. The results of this study are consistent with Wilhite (1988) in that easier test items (high prior knowledge) were influenced by signaling effects while difficult ones (low prior knowledge) were not.

Headings effects on free recall by familiarity. In two experiments examining the impact of headings on recall of prose, Lorch and Lorch (1996a) had 80 *Introduction to Psychology* undergraduates read a 2,400-word passage containing 12 topics and then complete a free recall task. Half of the topics were rated as familiar and half as unfamiliar. Although familiar topics were recalled more often than unfamiliar ones, the presence of headings in the passage improved overall recall of unfamiliar topics, $F(1, 60) = 6.02$, $p < .05$, but had no effect on familiar topics (p. 268). Consistent with other signaling research (Lorch & Lorch, 1995, 1996b), headings significantly improved recall of unfamiliar *main* topics, $F(1, 60) = 4.30$, $p < .05$, but had a slightly negative effect on recall of unfamiliar *subordinate* topics (p. 269).

Headings effects on text summarization by familiarity. In a second experiment involving 99 undergraduates and a 3,700-word reading passage containing 20 topics, Lorch and Lorch (1996a) found that headings improved recall on a summarization task for both familiar, $t(76) = 2.96$, $p < .05$, and unfamiliar topics, $t(76) = 3.68$, $p < .05$ (p. 272).

Also, headings enhanced recall of topics that were only briefly discussed in the text, $t(76) = 4.99$, $p < .05$, but had little influence on topics that were discussed at length.

Do signaling effects vary by text length and complexity?

Signaling effects on recall of main and subordinate topics. Lorch et al. (1993) conducted two experiments testing the effects of signaling (i.e., headings, blank lines inserted between sections, overviews, and summaries) on recall of main and subordinate topics. In experiment one, subjects were 203 Introduction to Psychology students. Each was asked to read one of eight versions of a reading passage, which varied based on length (3,600 words with 24 idea units or 2,400 words with 12 idea units), complexity (2-level vs. 3-level topic structure), and signaling (all present vs. all absent). Signaling improved recall, $F(1, 194) = 67.00$, $p < .05$; signaling had greater impact on shorter text (2,400 words) than longer text (3,600 words), $F(1, 194) = 5.51$, $p < .05$; and signaling improved recall proportionately more for text with a simpler topic structure (2 levels) than text with a more complex organization (3 levels), $F(1, 194) = 112.73$, $p < .05$ (p. 283). To summarize, signals were effective encoding aids and were more effective when the text was short and/or simple (2 levels and 2,400 words) than when it was long and/or complex (3 levels and 3,600 words).

Signaling effects on recall of short and long discussion topics. In experiment two (Lorch et al., 1993), 82 subjects were asked to read a 2,000-word passage that varied based on signaling (all present or all absent) and the counter-balanced mixture of short and long discussions of topics. Signaling improved recall of subordinate topics that were embedded in shorter discussions of a topic, $F(1, 78) = 35.53$, $p < .05$ (p. 285). In fact, non-significant differences favoring the non-signaled condition were found in recall of topics in longer discussions. Similarly, they found that the non-signaled group was able to provide a greater amount of information about the topics they recalled than the signaled group, $F(1, 71) = 5.06$, $p <.05$ (p. 286). Lorch et al. surmised that while signals improve recall of topics, particularly with short passages, they may do so at the expense of stimulating recall of topic-related subordinate information. In other words, signals may help the reader remember the organization of the passage but not necessarily the substance of it.

Signaling effects on recall of main and subordinate topics. In two experiments involving 139 college students, Lorch and Lorch (1996b) asked students to read a 1,750-word passage that did or did not contain signaling devices (headings, overviews, and summaries) and complete a free recall task assessing recall of main and subordinate topics. The researchers hypothesized that signaling is most likely to have an effect on overall recall if the text is complex. In the first experiment, the simple topic structure (6 topics) was tested but non-significant differences were found. In the second experiment, which involved the more complex topic structure (12 topics), significant differences were found for recall of *main* topics, $t(66) = 2.71$, $p < .05$, and recall of *subordinate* topics, $t(66) = 2.42$, $p < .05$ (p. 42), favoring the signaled condition. Total recall was significantly improved as well, $t(66) = 2.03$, $p < .05$. Based on these results, signaling enhances overall recall when the reading passages are complex (12 topics) and do not necessarily enhance overall recall when the reading passages are simple enough for the student to encode the topic structure effectively without additional help. This is consistent with Spyrikakis and Standal's (1987) study, in which signaling enhanced recognition memory only when the text was long and complex.

On the surface, the findings from Lorch and Lorch's (1996b) study run counter to their earlier study (Lorch et al., 1993) in which signals were more effective with short, simple text. However, in the earlier study, Lorch et al. (1993) operationalized *complexity* by manipulating the number of topic *levels* (2 versus 3), while in this later study, they altered the number of topics themselves (6 versus 12). Thus, comparing the two findings is problematic. One could draw the conclusion from these two studies that signaling is most effective with text that has no more than two levels, approximately 12 topic and idea units, and approximately 2,400 words. Text with less than 12 topics may be too simple to benefit from signals and, conversely, text with much more than 12 topics may be too complex to benefit from signals.

Signaling effects on conditional recall. In a third experiment involving 120 college students, Lorch and Lorch (1996b) found that signals did not improve conditional recall (recall of subordinate topics when main topic is recalled), which rendered their impact on total recall non-significant. From this and their prior studies (Lorch & Lorch, 1995; Lorch et al., 1993), Lorch and Lorch (1996b) conclude that while signals "influence the distribution of ideas and the organization of recall," these gains "do not necessarily translate into better overall recall because signals do not consistently facilitate recall of subordinate content concerning a topic" (p. 45). Lorch and Lorch also found that half signals (i.e., including headings, overviews, and summaries for half of the topics but not for the other half) improved recall of main topics for the signaled topics but depressed recall of non-signaled topics. In other words, signals appear to improve recall of signaled topics at the expense of non-signaled ones. This is consistent with Lorch et al.'s (1993) earlier findings. It is also consistent with a study by Robinson and Hall (1941), conducted primarily to compare comprehension scores and reading rates for different types of text (art, geology, fiction, Canadian and Russian history). They found that headings had non-significant effects on comprehension test scores.

Do signaling effects improve with training?

Headings effects on recall, structural knowledge, and recognition. Brooks, Dansereau, Spurlin, and Holley (1983) examined the effects of three signaling conditions (embedded headings, outline, and embedded headings with outline) on three dependent measures: recall (essay test), structural knowledge (outlining test), and recognition (28-item multiple-choice test). In experiment one, involving 132 college students, Brooks et al. found that headings had a significant effect on recall, $F(1, 112) = 5.15$, $p < .02$, and on structural knowledge, $F(1, 112) = 6.41$, $p < .01$, but not on recognition (p. 296). Headings improve recall of main ideas and knowledge of the organizational structure of the text. These results also suggest that recognition memory retrieval tasks, such as those often involved in multiple-choice and matching tests, are less sensitive to signaling effects.

Headings effects on recall with and without training. In experiment two, involving 106 college students, Brooks et al. (1983) examined the effects of training students on the use of headings versus the effects of headings without training. Training significantly improved recall, $F(2, 102) = 4.53$, $p < .01$, and structural knowledge, $F(2, 102) = 19.90$, $p < .01$, but again not recognition (p. 299). Either the multiple-choice test was not able to detect any existing signaling effects or recognition tasks are immune to signaling effects, even with training.

Headings effects on free recall with and without training. Sanchez, Lorch, and Lorch (2000) also examined the impact of training on headings effects. In their study, 140 undergraduates read a 1,425-word text, then students in the training condition were instructed to form a mental outline of the text. This encouraged them to focus on the organization of the reading passage. Sanchez et al. (2000) found that students who neither had training nor headings had lower topic access scores (recall of main topics) and lower total recall scores than students in each of the other three conditions involving training and/or headings, $t(136) = 3.05$, $p < .05$ (p. 8). However, the effects of training and headings were essentially equal and did not interact to produce greater signaling effects. Access to subordinate information (i.e., conditional recall) was not affected by either training or the presence of headings. These results are consistent with prior studies (Lorch & Lorch, 1995, 1996a, 1996b) that found signaling effects for recall of organizational structure but did not find signaling effects for subordinate information.

Signaling effects on problem-solving

Signaling effects on free recall and problem-solving. In an experiment involving 58 tenth-grade college preparatory track students who were asked to read a 223-word passage of expository prose, Loman and Mayer (1983) found that headings and other signals caused students to modify their reading strategies, helping them recall more information and generate higher quality problem solutions. Students were given a reading passage that contained 43 idea units and, for those in the signaling condition, also contained preview sentences, underlined passage headings, and logical connective phrases. Idea units were blocked by type: conceptual, general, and primacy/recency (first idea/last idea). Loman and Mayer (1983) found significant differences between the signaled group (with headings) and the non-signaled group, $F(1, 56) = 9.80$, $p < .01$, and for the interaction of the three classes of idea units, $F(2, 112) = 315.01$, $p < .001$ (p. 406), suggesting that signals impact retention of different ideas disproportionately.

Signaling effects for remedial learners on free recall and problem-solving. In a second experiment involving 44 tenth graders who were designated as "remedial" and who read a 153-word passage containing 26 idea units, Loman and Mayer (1983) confirmed their earlier findings that the signaled groups remembered concepts and general idea units better than the non-signaled group. Conversely, they found that the non-signaled group retained more of the primacy/recency idea units. They concluded: "signaling was effective in asserting selective effects on *what is learned*" (p. 408). In other words, the paragraph headings, previews, and connective phrases drew the learner's attention to the conceptual information, lessening their dependency on primacy and recency.

In a study involving 32 college students and a 670-word passage dealing with the nitrogen cycle, Mayer, Dyck, and Cook (1984) examined the signaling effects of introductory definitions and headings on two criterion measures: a free recall test and a problem-solving test (10 essay or computational problems). The signals were written to communicate the relationship among the main idea units, rather than merely the topic structure. Responses from the free recall test were grouped into four categories: (1) recall of conceptual information, (2) recall of primacy information (first 10 idea units), (3) total recall, and (4) verbatim recall of information. Responses from the problem-solving problem were grouped into two categories: (1) near transfer problems, which required specific information to solve, and (2) far transfer problems, which required the learner to use information in a creative way.

Signaling effects of introductory definitions on recall of concepts versus verbatim information and far versus near problem-solving. In the first experiment, Mayer and his colleagues (1984) predicted that since the introductory definitions presented in the signaling condition were designed to communicate a relationship model, students would recall more conceptual information and perform better in problem-solving tasks at the expense of remembering verbatim and primacy information from the passage. The learners in the signaled condition did recall more conceptual information, $t(30) = 3.84$, $p < .01$, even thought total recall was not higher (p.1094). The signaled learners also recalled less primacy information, $t(30) = 2.20$, $p < .05$, and less verbatim information, $t(30) = 2.54$, $p < .05$ (p.1094). At the same time, they performed significantly better on the far transfer problem solving test than the non-signaled group, $t(30) = 3.35$, $p < .05$, confirming that introductory definitions facilitate more creative problem solving (p.1095. Signaling, however, had no effect on the near transfer problem solving items.

Signaling effects of headings and introductory paragraphs on recall of concepts versus verbatim information and problem-solving. In experiment two, Mayer et al. (1984) examined the signaling effects of headings and introductory paragraphs. The study involved 30 college students and the same reading materials used in experiment one. Consistent with the first experiment, recall of signaled concepts increased, while recall of primacy and verbatim information decreased. Signaling also improved problem solving, $t(28) = 2.10$, $p < .05$ (p. 1098). Signaling draws learners to main ideas and reduces their dependency on verbatim memorization. By conveying a meaningful organizational structure of the content, signaling enhances problem-solving.

Do verbal signals interact with non-verbal signals?

Mautone and Mayer (2001) ran three experiments to examine signaling effects on two criterion measures, a free recall test and a transfer test. They began by examining signaling effects on recall and transfer. Then, the text was converted to audio narration so that the effects of audio signaling could be examined. Lastly, the researchers compared the effects of audio signaling with visual signaling, i.e., graphic animation.

Signaling effects on recall and transfer. The first experiment involved 48 college students and a 487-word passage containing 7 main idea units dealing with the principles of airplane lift. The signaled version of the text passage was identical to the non-signaled version, except that the signaled version contained headings, a preview summary, and connecting words. The headings were bolded, underlined, and shown in a slightly larger (14-point) font, while the connecting words were boldfaced and italicized. The results indicated that while signaling did not significantly enhance recall, $t(46) = 0.478$, $p = .63$, it did significantly improve performance on a transfer test, $t(46) = 2.15$, $p < .05$ (p. 384).

Signaling effects with audio narration. In experiment two, which also involved 48 college students, Mautone and Mayer (2001) used the same 487-word passage from experiment one, but this time it was presented in the form of audio narration without text. In the signaled condition, the intonation of audio headings and connective words were varied and an audio preview summary was added. The results indicated that this time, signaling significantly enhanced both recall, $t(46) = 2.005$, $p < .05$, and transfer, $t(46) = 2.77$, $p < .01$ (p. 384).

Signaling effects with audio narration and animation. In experiment three, involving 86 college students, the same signaled and non-signaled audio narration were used, but this time, they were complemented with signaled and non-signaled animation. The animation was signaled using colored arrows as guides for selecting relevant parts of the illustration (as headings would); by using color to show the organization and relationships among the different parts of the illustration (as connective phrases would); and by including an icon that the student could click for a summary. The results suggest that signaled narration in combination with non-signaled animation enhanced recall, $F(1, 82) = 4.01$, $p < .05$ (p. 386), but that signaled narration was actually impaired by signaled animation. The transfer test results show a similar pattern favoring narration. When both signaled narration and signaled animation were used, students performed significantly better on the transfer test, $t(44) = 2.76$, $p < .01$. However, signaled narration significantly improved transfer, $F(1, 82)$, $p < .01$ (p. 386), while signaled animation appeared to have almost no impact.

Mautone and Mayer (2001) concluded that verbal signaling (text and audio narration) significantly enhanced transfer to new problem-solving situations, but had only slight to moderate effects on recall. Animation, a non-verbal signal, had little or no positive impact on recall *or* transfer. Their findings suggest that verbal signals are stronger than non-verbal ones, and that when used simultaneously, they can compete for attention and for short-term memory space.

Summary

When headings and other signals are absent from instructional text, learners must rely on other sources of information to identify the key points covered in the reading passage. These sources include the learner's prior knowledge as well as the serial positioning of topics (e.g., important topics first and less important topics later) and the amount of elaboration provided in the passage (e.g., important topics are explained more thoroughly). Signaling devices explicitly highlight the key points of a passage and communicate the structure of the text.

When are signals most effective? Signals do not necessarily increase the total amount of information recalled. Rather, they mainly alter the learner's reading/encoding strategy (Loman & Mayer, 1983). Several studies have shown that signaling significantly improves recall of main topic words and phrases (Brooks et al., 1983; Hartley et al., 1980; Krug et al., 1989; Loman & Mayer, 1983), with both cued and free recall tasks. Signals, however, do not necessarily improve recall of subordinate information (Lorch & Lorch, 1996a). In fact, headings and other signals shift the focus of attention during encoding to the signaled information and away from the non-signaled information (Krug et al., 1989; Lorch & Lorch, 1996b; Robinson & Hall, 1941). Although signaling may not improve recall of subordinate information, it does enhance transfer of knowledge to new situations, thus aiding in problem-solving tasks (Mautone & Mayer, 2001; Mayer et al., 1984). Signaling is an appropriate strategy when recall of the cued topics is important and when the key topics are communicated to facilitate problem-solving.

Multiple-choice, matching, and other recognition item formats appear to be less sensitive to signaling effects compared to cued recall and free recall tasks (Christensen & Stordahl, 1955; Marcinkiewicz & Clariana, 1997; Spyridakis & Standal, 1987). Smith's (1986) outshining hypothesis posits that environmental cues enhance memory retrieval when the to-be-remembered information is difficult and do *not* when it is easy to remember. Recognition tasks are generally easier than recall tasks, and so this may explain why signaling is less effective with multiple-choice tests than it is with recall tests. The difference may also be due to ceiling effects (Spyridakis & Standal, 1987), which are more likely to influence easier test formats.

Statement headings and question headings are equally effective (Hartley et al., 1980). Headings are not any more effective than other signaling devices (Lorch & Lorch, 1995). However, headings are highly effective when grouped with other verbal signals (Brooks et al., 1983; Hartley et al., 1980; Loman & Mayer, 1983; Lorch & Lorch, 1996a, 1996b; Lorch et al., 1993) but are not more effective when combined with non-verbal signals (Mautone & Mayer, 2001).

Signaling effects are strengthened when the information is cued at retrieval (Lorch & Lorch, 1995). Signals are e

specially helpful when the text is approximately 2,400 words in length and has approximately 12 topics with no more than two levels (Lorch & Lorch, 1996b; Lorch et al., 1993). Text that is too short and simple or too long and difficult may not benefit from signaling effects.

Implications and Conclusion

Instructional designers and educators commonly use headings and other signals when writing instructional text for paper-based and screen-based materials, regardless of the instructional objectives. The research suggests that headings and other signals can be powerful textual cues that alter the encoding strategy of learners. While headings can promote recall of main topics and enhance problem-solving, they are not helpful in promoting reading comprehension. In fact, signals tend to cause learners to remember key ideas at the expense of subordinate information that may be crucial to understanding. This implies that writers of instructional text should consider the kinds of instructional objectives sought before deciding whether or not signaling will be helpful or counter-productive.

If headings are being used for the purpose of enhancing recall, they will be most effective when used in conjunction with other verbal signaling devices, such as introductions, summaries, transition statements, and titles. Headings will be most useful when the text is moderately long and complex, and when comprehension of the subordinate information is less important than understanding of the main points.

Much of the signals research involves paper-based instructional materials but few involve screen-based materials. In online venues, instructional text can assume complex forms, with text hyperlinked to subordinate or related content, so the text is not always sequentially ordered, and elaboration is dependent on the user's desire to explore by clicking to reveal deeper layers of information. In such settings, would verbal signaling devices be more helpful or less helpful in promoting recall, comprehension, and problem-solving? Given the increasing use of non-verbal cues, such as icons, graphics, animations, and color, do they compete with or else complement verbal signals in different virtual settings? Given the proliferation of computer-based and web-based courseware, online distance learning, and electronic textbooks, future signals research should reevaluate the effects of headings and other signals in the digital medium to provide designers clearer answers to such questions.

Headings are valuable signaling devices that have been shown to promote recall of main ideas, knowledge of organizational structure, and problem-solving. They draw the learner's attention to the key topics in a reading passage. These key topics form the topography of the text based on the organizational structure of the passage. As such, they implicitly contain relationships and other structural information. Tasks and skills that benefit from this improved structure of the content are therefore likely to benefit from signals. However, it is critical to recognize that these gains are made at the expense of memory for subordinate information.

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Internet Filtering Software: A Review of the Literature and the Use of Filtering Software in Colorado Public Libraries

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Abstract:

The purpose of this study is to examine the effectiveness of Internet filtering software, the current use of filtering software in Colorado public libraries and the costs public libraries would incur should Internet filtering software become a state mandate. First, the Internet is briefly discussed, including the beginnings of this global information superhighway, as well as its original intent. Second, the important issues surrounding Internet access in public libraries are presented. Third, a discussion of Internet filtering software including some of the products available and how the software works is presented. Finally, the results of a survey of Colorado public libraries' use of Internet filtering software are discussed, including recommendations for the future.

Introduction to the Internet: a brief history

The Internet is a series of computers connected together to form a "web" or global network of computers. As a result of this connectivity, files and pages can be downloaded to any computer with a connection to the network (Barker, 2002; http://www.pcwebopedia.com, 2003). Millions upon millions of pages are available on the Internet, and anyone with access to server space can create a page, post it, and link it to others (Barker, 2002; http://www.pcwebopedia.com, 2003).

The Internet began as a United States Department of Defense network in the 1960s that would continue to function in the event of a disaster, such as a nuclear war. The original network, connecting scientific and academic researchers, was called Advanced Research Projects Administration Network (ARPANET) (Kirstein, 1998). In 1985, the National Science Foundation created NSFNET, which was a series of networks designed to allow educators and researchers to communicate. Based on the protocols developed by ARPANET, a backbone network was created to link any U.S. educational or research institution (Gaston, 1995).

Software to make access to the network clearer and more user- friendly was created and telecommunication companies began to build their own networks to make access to the global network more convenient (Hardy, 1993). As faster computers have become more affordable over time and are now available to a larger percentage of the population, Internet use has grown dramatically (Bushong, 2002; Hardy, 1993; Leiner et al, 2000). According to the 2000 census, 54 million homes (51%) reported having one or more computers, and 44 million households (42%) reported at least one person using the Internet at home. Of children age 3 to 17, 65% lived in a house with at least one computer, and 30% of the children use the Internet at home (U.S. Bureau of Census, 2000). In a study of computer users in the United States, 10% of Internet users reported their online activities take place at a public library (U.S. Department of Commerce, 2002).

What is Internet filtering software?

The primary way of preventing end-users from accessing objectionable material is increased adult involvement in children's online activities (Bushong, 2002). However, this is not always feasible in a public library. Following recommendations for Internet safety that suggest putting Internet terminals in high-traffic areas (Bushong, 2002), libraries have tried to arrange computer banks so monitor screens face into the center of the room and are not isolated. This solution still requires constant supervision by library personnel, and can be costly in the amount of time required to properly monitor this area so public libraries must rely on technological solutions (Bruce, 1999).

There are two ways Internet content can be filtered for the end-user: either a hardware solution, such as a filtering "box" that scans material before it ever reaches the screen of the end user; or Internet filtering software, which works with an Internet browser to block certain types of pages and/or information that is labeled as undesirable, inappropriate or illegal as it reaches the end-user's computer. There are dozens of software packages commercially available, ranging in price from $20 to well over $2,000, depending on features, the number of users, and whether it is terminal- or server-based (Bruce, 1999; Smith, 2000).

Solutions fall into several categories: (a) server-side filtering software using a specific URL list for blocking, (b) terminal-based filtering software using a browser that will not allow certain types of material to load, (c) terminal-based filters that block certain text, and (d) filtering software that uses labeling and rating systems and will not allow material that is not within acceptable limits to load (COPA, 2000).

In a 2001 nation-wide study, 44% of public libraries indicated they use some form of filtering software, but those libraries that filter only some computers indicate the filtered computers are only in the youth areas (Curry & Haycock, 2001). Approximately 69% of public libraries that do not filter had no plans to install any filtering software in their library. Most school libraries that use filtering software, while for the most part happy with the software's ability to block the objectionable sites, are dissatisfied at some level with the software's ability to allow appropriate sites through the filter (Curry & Haycock, 2001).

How Internet filtering software works

As stated previously, filtering software can block content based on forbidden words, a list of forbidden websites (URLs) or protocols (such as e-mail, chat rooms or bulletin boards) (Consumer Reports, March 2001; Smith, 2000). The software works in conjunction with a web browser, such as Microsoft's Internet Explorer or Netscape Navigator, to block Internet content by previewing content before the page is loaded by the local computer (Barker, 2002). Some Internet blocking software packages block as few as six categories, but some block many more (Curry & Haycock, 2001; Edelman, 2001; Hunter, 2000). Some of the blocked categories may include intolerance, violence/profanity, nudity, sexual acts, satanic/cult, drugs/drug culture, hate speech, criminal activity, sexually explicit speech, "adult" speech, violent speech, religious speech, and sites that have a link to secure sites such as e-commerce sites, sports or entertainment (Hunter 2000; Lipow 2000).

Several different studies of different Internet filter software packages have determined that the software packages studied were ineffective, by either under-blocking content (allowing objectionable material through the filter) or over-blocking content (not allowing appropriate and useful sites to load) (Hunter, 2000; Janes, 2002; Lipow, 2000; Nabel, 2000; Schneider, 1997).

Typical inappropriately blocked sites include terms such as "xxx" (which also blocks all sites that talk about Superbowl XXX) and sites containing any mention of specific parts of the human body (which also blocks sites about chicken breast recipes or sites about breast or testicular cancers). Sites that discuss feminism or gay and lesbian issues are often blocked, while sites that oppose homosexuality are not blocked (Hunter, 2000). Pages with pictures might be inappropriately blocked as well – a photo titled "adult.jpg" depicting an adult sitting on a park bench would be blocked because of the "adult" designation (Consumer Reports, March 2001) while another photo with an unblocked name containing nudity would not.

Additionally, some Internet filtering software will not allow access to sites that the Internet filtering software company has not rated (Edelman, 2001). With new sites and pages being added to the Internet daily, filtering software is unlikely to be completely up-to-date. These filters often block appropriate sites because the filtering software often does not consider the context in which a word or phrase is used.

It is far more troubling when a filter appears to block legitimate sites based on moral or political value judgments (Consumer Reports, 2001; Rideout et al, 2002). As an illustration of an Internet filtering software's performance, it should be noted that the travel site for Castle Rock, CO, is blocked by at least one of the filtering software packages studied (Edelman, 2001). Many of the relevant studies about Internet Filtering software can be found summarized in Appendix C.

What issues are important in public library Internet access?

What is a public library? Is a public library a safe haven where parents can send their children, knowing they will be protected from controversial issues; or a place of free speech where many types of materials are available to the public?

When the Internet came into widespread use, it became necessary for public libraries and schools to provide a connection to this "information superhighway." Recent federal initiatives emphasize the importance of using technology in schools. The Schools and Libraries Universal Service Support Mechanism (known as E-rate) allowed schools and libraries across the nation to receive discounted telecommunications and Internet services (Revenaugh, 2002; USAC, 2002). Nationwide, approximately 95.7% of public libraries offer Internet access and nearly all have some sort of acceptable use policy (Estabrook & Lakner, 2000).

Filtering Laws. With the growing number of "inappropriate" pages available on the Internet, Congress has passed a variety of laws attempting to limit the content made available in public places on the Internet (Samoriski et al, 1997). The Communications Decency Act of 1996 was passed by Congress but was struck down by the Supreme Court on June 26, 1997 on First and Fifth Amendment (Madison, 1791) grounds in a 7-2 decision (ACLU v. Reno, 1996).

Congress next passed the Child Internet Protection Act (CIPA) of 2000, which ties library funding to the mandated use of filtering software on Internet terminals that could be used by both adults and minors in public libraries (H.R. 4577; Public Law 106-554). Because libraries are funded by state and federal funds, fund reception was tied to compliance with CIPA. Libraries that did not comply with CIPA by July 1, 2002 would need to decline their government sponsored funding and discounted Internet access under E-rate. Libraries accepting the funding needed to submit certification by October 28, 2002 that steps had been taken to comply with CIPA. However, the United States District Court for the Eastern District of Pennsylvania found that CIPA was "facially invalid" under the First Amendment to the United States Constitution (American Library Association et al v. United States of America et al, 2002; Multnomah County Public Library v. United States of America et al, 2002). The Supreme Court of the United States has agreed to hear the government's appeal and a hearing has been set for March 5, 2003.

Public library attempts to conform with current legislation to restrict Internet access to its patrons have also been called into question (Mainstream Loudoun v. Board of Trustees of Loudoun County Library, 1998). Filtering software was used in public libraries before federal mandates were installed. However, many of those restrictions have been successfully challenged. In *Loudoun*, a federal court in Virginia found that a library's use of an Internet software filter violated the First Amendment. Several experts offered testimony in this case (Janes, 1998; Lipow, 2000; Edelman, 2001), indicating that too many sites of legitimate use and interest were being blocked by one or more Internet filtering software packages (Doyle, 2002; Eysenbach & Diepgen, 2001). While software has improved since *Loudoun* (James, 1998), there are still sites blocked by Internet filtering software that are of legitimate interest to the general public (Newberger, 2001; Smith, 2000; Edelman, 2002). Filters are unable to block 100% of Internet content that falls into certain categories while simultaneously allowing access to other similar but appropriate content (Expert Report, Edelman, 2001; Rebuttal Report, Edelman, 2001). A 2002 study found that when simulating health searches using several different available Internet filters at different restriction levels, access to between 1.4% and 25% of appropriate health sites were denied, depending on the level of restriction at which the filter was set (Rideout et al, 2002; Minkel, 2003).

Use of Internet filtering software in Colorado Public Libraries

The purpose of this study is to examine the effectiveness of Internet filtering software, the current use of filtering software in Colorado public libraries and the costs public libraries would incur should Internet filtering software become a state mandate. The research questions examined were:

1) What is the cost to a library jurisdiction to filter? This includes not only the cost for the software, but also the cost in hardware, staff time and staff training.
2) Is there a relationship between the cost and effectiveness of Internet filtering systems?
3) How many Colorado public libraries currently use Internet filtering software?

Methodology

A survey was sent to all public library jurisdictions in Colorado according to a list generated by the Colorado State Library. The survey asked for the name of the library jurisdiction to determine participation. Questions included whether the library jurisdiction owns at least one computer with capabilities to run most Internet filtering software (to rule out deficient equipment questions) and whether the library jurisdiction is filtering all or part of their Internet access terminals. Other questions asked for the name(s) of filtering software being used, the cost of the software, related equipment, and staff. Finally, several options were given as reasons for the decision to filter or not filter in that particular library jurisdiction. The survey was sent twice to all respondents either as an e-mail attachment or by the United States Postal Service. Additionally, a message was posted to the Public Library Director's listserv, asking for participation.

Results

The population for this study is the public libraries in the state of Colorado. Of 116 public library jurisdictions in the state, 54 surveys were returned either via e-mail attachment or a pre-stamped envelope, yielding a 46.6% response rate. The responding library jurisdictions were 53.7% small libraries (15 computers or less) and 46.3% large libraries (more than 15 computers) Because library jurisdictions have varying numbers of library buildings, the survey was given to library directors and included from one building to the largest library jurisdiction in Colorado, containing 23 branches. Data was obtained through the use of a voluntary survey that was sent to and returned by the respondents; the sample was obtained by library jurisdictions that chose to participate. It should be noted that the survey was sent out less than one month after the required annual survey administered by the Colorado State Library, which may have adversely affected the response rate for this study.

All respondent library jurisdictions reported having at least one IBM-compatible computer with a minimum level of RAM, hard drive space, operating system and processor speed necessary to run most Internet filtering software packages. Eleven of the respondent library jurisdictions reported having at least one Macintosh computer as well as at least one IBM-compatible computer (see Figure 1) and there were two non-respondents. There were no Macintosh-only environments. The number of computers in each library jurisdiction ranged from two in the smallest library jurisdiction to 760 in the largest responding library jurisdiction.

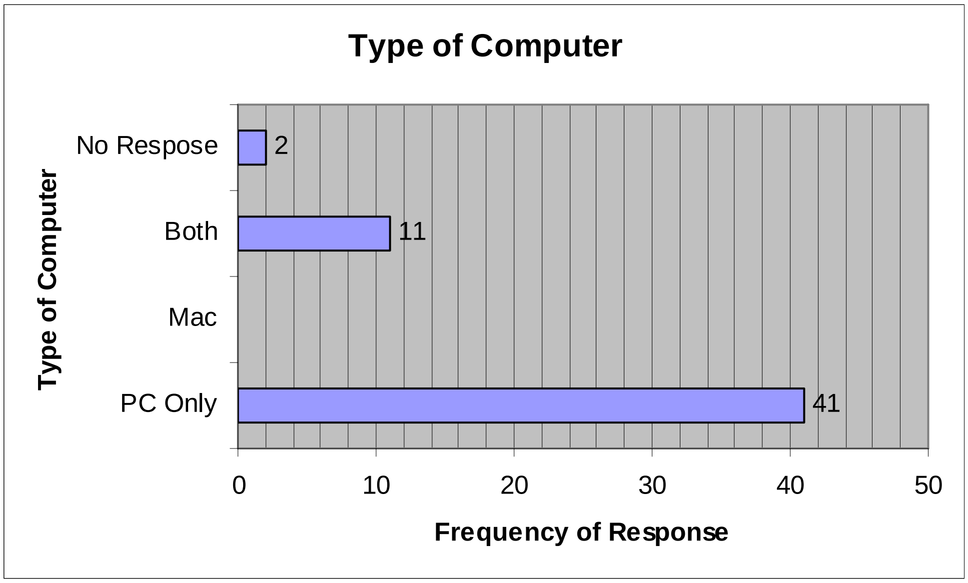

Figure 1: Type of computer as reported by responding library jurisdiction

Of the respondent library jurisdictions, 12 (22.2%) reported having some level of filtering software in their libraries (see Figure 2), and 41 (77.8%) report not using filtering software. Of those that filter, two-thirds are large (more than 15 computers) libraries.

Category	Frequency of response	Percent
Filter all computers	7	58.3%
Filter some computers	5	41.7%
Filter all computers in the children's area	8	66.7%
Filter some computers in the children's area	1	8.3%
No computers in the children's area	4	33.3%

Table 1: *Summary of Key Findings for Filtering Library Jurisdictions*

Five of the filtering library jurisdictions were required to purchase equipment not already available at a cost of over $1000 per library jurisdiction. Filtering software was installed in those libraries as early as 1997 and as recently as 2001 (see Table 1). Of those twelve, nine (75%) of the filtering library jurisdictions filter some or all of the computers in the children's area in the library. The libraries that report not filtering any of their computers include the smallest responding library jurisdiction (two computers) and the largest responding library jurisdiction (760 computers) with a median of 14 computers. Four of the total respondent library jurisdictions (7.4%) report that the computers in the children's areas are not Internet-accessible.

Year Installed	Number of installations
1997	1
1998	1
1999	3
2000	2
2001	1

Table 2: *Installation year of Internet filtering software*

Filtering Libraries. Libraries reported using a variety of Internet filtering software packages or arrangements. Twenty-five percent of filtering library jurisdictions use a server-side filter with varied levels of filtering (usually three to five levels). Access to different levels is obtained by an automated card reader or a regularly changed password obtained at any of the library's desks. For libraries that use a permission or password system to circumvent the filtering system, parents can either sign Internet use forms or obtain the password for their minor child to allow them full access. Library jurisdictions that require a password do not question an adult 18 years of age or over who requests the password. Three of the libraries that filter only part of their computers report the use of privacy screens to prevent unauthorized persons from seeing potentially inappropriate material.

Several reasons were offered for the decision to filter Internet connections, which included CIPA, Director's decision, Board Policy, Community Request, and Incidence of Misuse, which are summarized in Figure 2. In addition to the given reasons, several library jurisdictions used the 'other' option to give the following reasons that did not fit in one of the given categories. Their responses were as follows:

- *Filtering was originally recommended by the State Grant.*
- *Request for filters was initiated by a single member of the City Council. [We] were not required to filter until Internet computers became available in the children's room. We have purchased privacy screens for the two unfiltered computers at about $230 each.*
- *School wanted to do it.*
- *Two computers were purchased and maintained by the *** school district, and they have the filter.*
- *Basically the grant was written so we would be connected to the school district's computers so that's how it turned out.*

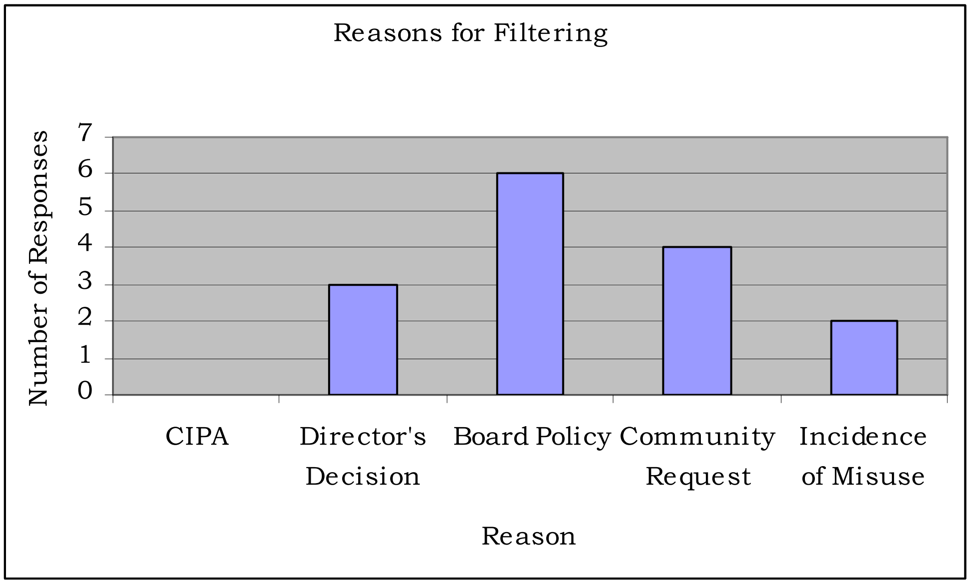

Figure 2: Reasons for Internet filtering, as reported by libraries

Non-filtering library jurisdictions. Several reasons were offered as reasons for the decision not to filter Internet connections, including Director's Decision, No need/No problems, Board Policy, and Community Request, which are summarized in Figure 3. In addition to the provided options, several libraries that report not filtering used the 'other' option to give the following reasons that did not fit in any of the given categories. Their responses were as follows:

- *Cost was prohibitive, especially in terms of staff time. We have minimized the problem through use of privacy screens, PC placement, policies, web design and family training.*
- *The decision not to filter was made by the Director with the knowledge and support of the Board. We perceived "no need," not from a complete lack of problems, but from very few problems. Of course there have been some problems. Our patrons are human, after all.*
- *Computers were done on the Bill Gates grant to libraries from the previous director. She never felt the need for the filtering system. In addition, [there was] no budget.*
- *We visually monitor all public access machines, which are located in full view of [the] circulation [desk], [the] reference [desk], [and the] children's librarian's desk. FILTER'S DON'T WORK! And, by all means not incidentally, we believe in the First Amendment and regard its defense as our number one priority.*
- *Freedom of information; also, I do not believe filtering actually works. Materials are filtered which shouldn't be (fine arts, health) and not filtered that should be.*
- *Our IT Department tested them and they don't work! Therefore, we didn't want to provide parents with a "false sense of security." We decided not to allow Internet on the computers in our Children's Room, because we often have just one person working in the library and cannot see what is going on in our downstairs Children's Room. We have an Internet Use policy in place of filters.*
- *Town of 500, easy to monitor – computers right next to director's desk!*
- *Gates computers are very proprietary and we decided – not worth it. We use parental permission instead.*
- *[We] believe [filtering to be] unconstitutional.*
- *Public Computer Use Policy that is in compliance with CO state statute, and CIPA, is posted by each computer, clearly stating that violation of rules of use results in loss of library privileges. Reference sites for students have been book-marked. The computers screens are within 15 feet of and facing librarian's desk. In seven years there has only been one violation.*
- *[The] librarian monitors the computers.*
- *It does not work & it is a form of censorship*
-

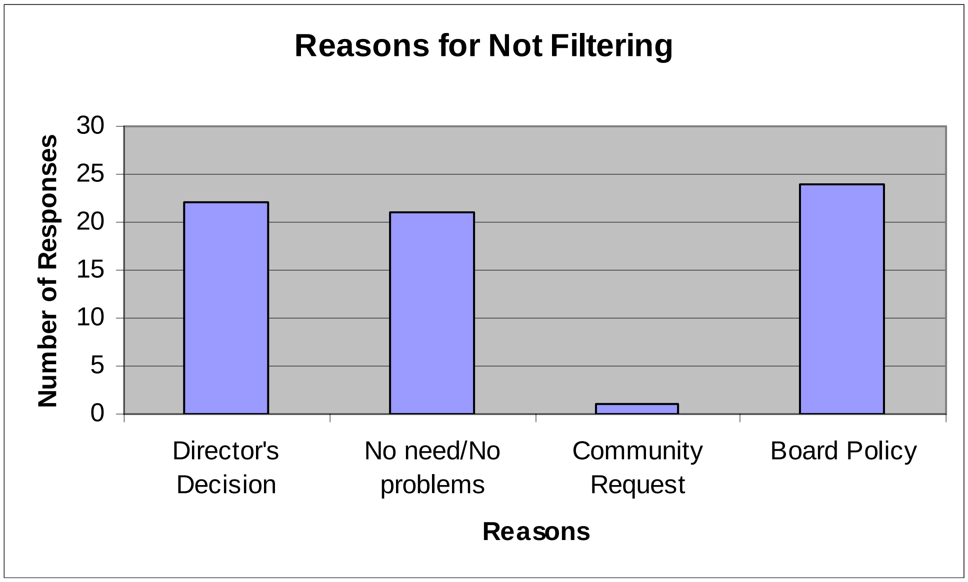

Figure 3: Reasons for not filtering, as reported by libraries

Internet use policies. According to the Colorado State Library, Internet use policies were required as part of state funding. Each library has an appropriate Internet use policy on file with the Colorado State Library.

Cost of filtering. The cost of filtering varies depending on the features of the chosen filtering software or equipment, the extent of filtering desired by the library and whether the filter is software-based (on each individual computer terminal) or server-based (at a distant location that filters the Internet connection before it reaches the computer terminal). Table 2 represents the initial cost of filtering per library for the eight libraries that provided this information (Please note: library jurisdictions are identified by case number.)

Jurisdiction	**Initial Cost**
27	$49.99
13	$64.00
32	$182.48
46	$350.00
25	$450.00
1	$600.00
9	$6,000.00
41	$44,000.00

Table 2: *Initial Financial Impact of filtering*

Five of twelve responding filtering library jurisdictions chose a server-based filter system. One of those elected to institute a 'SmartCard' system, which included significantly more equipment than just the server necessary to institute filtering on all computers in the library. The other four that elected server-based filtering products faced an average financial outlay of $5281.00 for the server and the software package. Costs for the service alone varies depending on the number of computers being filtered; servers will generally run between $1000.00 and $2000.00, depending on the needs of the library and other functions the server is to perform. The other four libraries reported a cost of between $49.99 and $600.00 per computer for terminal-based software, with an average cost per computer of just under $303 per computer.

In addition to the initial cost, there is also an annual cost for current subscriptions to the service and updates or yearly maintenance. Figure 5 depicts those costs for the seven library jurisdictions that provided this information.

Jurisdiction	Annual costs
27	$39.99
25	$450.00
7	$1,500.00
32	$1509.00
9	$2231.00
24	$3,000.00
41	4,300.00

Table 3: *Annual subscription and maintenance cost of filtering*

For the library jurisdictions electing to use a server-based filtering package, the average annual maintenance and subscription service is approximately $3177.00. Terminal-based software is not run on a server that requires yearly maintenance, but does require a subscription renewal for software updates. The average annual cost as reported by Colorado libraries for subscriptions is $874.75 per computer.

Library jurisdictions that filter their Internet connection were also asked about the time spent training staff to monitor patron use of the Internet filtering software, such as time spent having to activate the software for a minor and deactivate it for an adult. The responses are displayed in Figure 4. While for most (67%) of filtering libraries, the cost associated with staff time was minimal, 17% of the filtering libraries reported more than $2000 spent in staff training time to monitor Internet filtering software, and 16.7% report the expectation that staff training relating to their Internet Filtering Software to continue as a yearly expense.

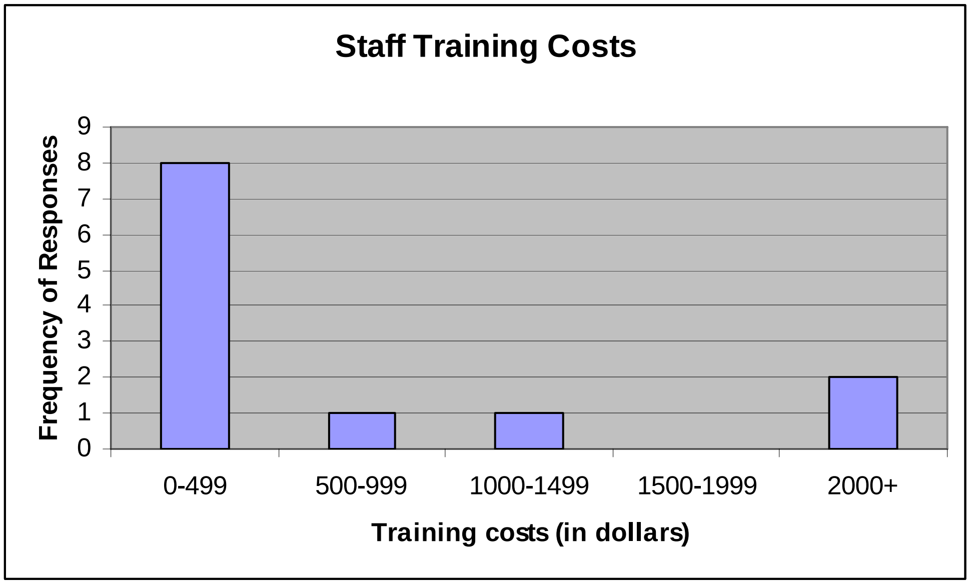

Figure 4: Cost in staff training for Internet filtering jurisdiction

Conclusion

Based on data from the study and comments made by individual library directors in the state of Colorado, it appears that to impose a mandatory Internet filtering policy in Colorado public libraries would impose financial, ethical, and legal hardship for public libraries across the state.

Should a mandatory filtering law be passed in Colorado, several problems would develop. First, libraries dependent on government funding would face the huge financial hurdle of purchasing appropriate hardware and software. Many of the terminal-based software programs, while seemingly more reasonable in initial outlay, are not as effective, and many of the libraries using these programs report a sizable use of staff time to turn the filtering software on and off for patrons of different ages. Smaller libraries that do not have a server would be required to purchase one to institute the more reliable server-side software, which is more expensive than traditional terminal-based software. Not including the cost in staff time, the appropriate budget per computer for a reasonably priced server and server based-software, including yearly subscriptions, reaches nearly $2,000 per computer. Subscriptions for terminal-based software can range from less than $30 per terminal to more than $100, but research has shown most of these to be ineffective, by either under-blocking content or over-blocking content.

Second, the ethical debate on the definition of an American public library would intensify. Public libraries should not be responsible for filtering information deemed "appropriate" by one individual. While libraries can and do use reasonable judgment in allowing minors to access inappropriate material, it is the constituents of that library district who should have the final say about what is kept in the library their tax dollars support; the decision to filter needs to be controlled at the local level. It would seem reasonable to require filtering on all Internet-accessible computers in the children's area only or to require filing with the state an appropriate Internet Use Policy that all patrons or legal guardians of patrons would be required to sign, but a mandatory filtering law could very easily be challenged on its merits.

Third, a legal battle could ensue if libraries are required to filter all Internet access. Should the decision by the District Court of Eastern Pennsylvania be upheld by the Supreme Court and CIPA overturned, libraries would have to discontinue use of filtering software or risk legal action for violating their constituents' First Amendment rights. In addition, it is reasonable that the State of Colorado would be named as a defendant in any such legal matter for passing a law that is unconstitutional. The United States Constitution and the First Amendment cannot be ignored: "***Congress shall make no law*** respecting an establishment of religion, or prohibiting the free exercise thereof; or ***abridging the freedom of speech, or of the press***; of the right of the People to peaceably assemble, and to petition the Government for a redress of grievances (emphasis added) (Madison, 1791)." As stated above in the review of the literature, all other laws regarding the prevention of access to information in a public library have come under scrutiny and been overturned by the Supreme Court, and there is no reason to believe CIPA will be an exception. It seems prudent to delay the passage of any state mandate regarding the use of Internet filtering software or regarding any related issues until the Supreme Court has acted on CIPA.

Professor Lawrence Lessig, noted cyberspace law expert at Stanford University Law School, stated that mandatory filtering is not the answer. While parents may be able to prevent their children from accessing inappropriate Internet content, states cannot become censors for children (1998). Any attempt at mandatory Internet filtering in any state would be nothing less.

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PFnet Translation: A Tool for Concept Map Quantification

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Abstract

Concept maps provide an attractive external representation of knowledge, but they are idiosyncratic and therefore difficult to compare across studies and educational assessments. Translation into Pathfinder Networks (PFnets) is one approach to solving this problem. By calculating the distance between all the pairs of nodes within a given concept map, researchers and evaluators can isomorphically translate a concept map into a Pathfinder Network (PFnet). Thus quantified, concept maps can be compared (a) with a normative domain model, (b) across learners, and (c) longitudinally to measure changes in understanding over time. Maps can be aggregated, allowing cross-sectional or longitudinal comparison of groups. The author describes the translation method and provides examples of translations and analyses. Data are protocol responses generated by fifty-seven fourth and fifth-year preservice elementary teachers after completing a unit of metaphor-enhanced, computer-mediated instruction.

Introduction

In practice, assessment through concept mapping has been inconsistent and riddled with considerable variety in (a) the individual subscores employed for scoring concept maps, (b) the underlying theoretical rationale for subscore selection, and (c) subscore weighting scales (Edmondson, 2000; Markham & Mintzes, 1994; Novak, 1990; Novak & Gowin, 1984; Wallace & Mintzes, 1990). Evaluators score any combination of the number of conceptual branches, hierarchical levels, intersections between branches (cross-links), and links between concepts (propositions). Unfortunately, some subscore and weighting combinations reward learners for superficial knowledge structures. Additionally, although concept map scorings measure the richness of mental models, they do not readily afford comparisons of the structure of learners' mental models. In contrast, Pathfinder networks (PFnets) appear to provide a rigorous and unbiased tool for model comparisons. PFnets derive from graph theory, a branch of mathematics (Schvaneveldt, 1990). PFnets contain nodes (concepts) and the connections between nodes (relational links). A network is a set of nodes and links. When constructed, PFnets look very much like concept maps: ovals connected by lines. There is one big difference between the two. PFnets are mathematical entities. As such, they are inherently composed of quantities and relationships. They *are* sets of numbers. Therefore, PFnets can be accurately compared over time, across students, or to an expert model. They can be statistically analyzed. Accurate and consistent translation of concept maps into PFnets might reduce the reliability or accountability problems associated with concept map scoring. This paper describes a method for translating concept maps into PFnets as well as an example of PFnet analysis of protocols produced within an empirical study of metaphor-enhanced, computer-mediated learning environments.

The Structure of the Concept Map

Psychologically, people view knowledge domains as systems of objects, object-attributes, and relations between objects (Gentner, 1983, p. 156). Visual tools, such as concept maps, represent knowledge domains graphically (see Figure 1). Within a concept map, the object is a concept; it is represented as a labeled oval. Arcs represent relations between concept dyads.

Joseph Novak and his colleagues (Novak, 1990; Novak & Gowin, 1984; J. D. Novak & Musonda, 1991) developed the concept map as a research tool for assessing changes in learners' mental models resultant from instruction. The structure and characteristics of the map derived from David Ausubel's (1962; 1963) assimilation theory. The theory posits that knowledge structures are hierarchical, with superordinate concepts subsuming subconcepts. In addition, people organize knowledge through two cognitive processes. During progressive differentiation, learners sort and gather domain subconcepts into conceptual strands. During integrative reconciliation, learners construct relational connections between disparate conceptual strands. Within a concept map, dyads of two concepts and the relationship that joins them form a proposition (Gentner, 1980, 1983; Novak & Gowin, 1984). The number of propositions within a concept map measures the extent of an individual's domain knowledge. The other subscores measure degrees of processing evidenced within a concept map: number of hierarchical levels measures subsumption, number of conceptual branches measures differentiation, and number of cross-links measures integration. Well-developed mental models of targeted domains contain greater numbers of propositions connected through subsumptive hierarchy, progressive differentiation, and integrative reconciliation. Mental models held by domain experts and highly successful domain learners evidence well-developed hierarchical structure, differentiation, and integration (Edmondson, 2000; Fisher, 2000), and "domain-specific knowledge has been shown to be a critical component of competent performance" (Fisher, 2000, p. 203) as well as an accurate domain-specific predictor of an individual's ability to problem-solve (Gordon & Gill, 1989).

Reese (2003a) has demonstrated that, in at least one domain (educational philosophy: functionalism), concept map cross-links are more sensitive indicators of well-developed mental models than the other subscores. The number of propositions follows as the second most sensitive subscore. There is very little difference between the number of hierarchical levels or differentiation branch subscores evident in concept maps when concept maps constructed from undeveloped mental models are compared to concept maps constructed from well-developed mental models. Relative subscore sensitivity suggests that weighting scales should reward cross-links and propositions. While summed subscale scorings afford evaluation and comparison of the richness of learners' mental models, the idiosyncrasy of individual maps precludes structural comparison (a) to an expert model, (b) across learners and (c) over time. Inter-map comparison of relational structure requires a quantified, relationally isomorphic equivalent and a translation methodology.

A Quantified Concept Map

The concept map illustrated in Figure 1 is the graph of a Pathfinder network produced using PCKNOT software, the *K*nowledge *N*etwork *O*rganizing *T*ool for the IBM *PC* (McDonald, Schvaneveldt, & Sitze, 1998). PCKNOT uses an algorithm to calculate a Pathfinder network (Schvaneveldt, 1990) from relational specifications and quantification of their strengths. The graph consists of set of nodes and all the links that join node dyads. Nodes are analogous to concept map concepts and links are analogous to concept map relations.

Within a network, a path is a journey through a set of linked nodes, from an initial node to a terminal node. The path moves through adjoining concepts and relations (like a baseball player moving along the bases, with the bases as analogs for nodes and the baseline segments as links). For example, the path ($path_1$) from ascribed characteristics to informal education in Figure 1 actually moves according to the path illustrated within Figure 2: ascribed characteristics (node) **leading to** (relational link) social change (node) **evidenced in** (relational link) informal education (node). The length of a path corresponds to the sum of the number of unique links traversed in moving from the initial node to the terminal node. The length of $path^1$ is 2.

A graph represents the structure connecting a set of nodes and can be displayed as an image, like the one in Figure 1. When positive, real numbers are assigned to each link in the set, the graph becomes a network. The weight of a path is the sum of the weighted links. PCKNOT calculates the geodesic for each of the set's node dyads; that is, it calculates the shortest possible path between each of the nodes. Thus, for a set of nodes and links, a network specifies structure (the graph) and quantifies it (the weighted geodesics). If the weight of every link in a network equals one, then the network equals the graph. Although Figure 2 is relationally equivalent to Figure 1, it looks different for two reasons: (a) the translation methodology is based on setting the link weights to one and (b) PCKNOT drew the relational links to scale. When plotting consists of equidistant links, the characteristics of this expert model cause the nodes to superimpose, as in Figure 1. Standardization of link length within the PFnet constrains the PCKNOT placement of concept nodes such that informal education and role differentiation must overlap on the graph. PCKNOT software will allow the researcher to drag the graph nodes that overlap while maintaining the relational links. A researcher could drag the nodes in Figure 1 to make it look exactly like Figure 2.

Relational Linkages

Originally, concept map propositions consisted of labeled concepts and unlabeled relational links. Over time, Novak and his colleagues developed mapping conventions: (a) relational links are labeled and (b) relationships are assumed to be directional, flowing from top to bottom (Novak & Gowin, 1984). Pathfinder networks do not specify the semantic content of the links (Schvaneveldt, 1990) and the software allows for the specification of both bi-directional (two-way) and unidirectional (one-way) paths. Other semantic modeling software system may require slightly different input. For example, SemNet/Semantica software (Fisher, 2000; Semantic Research Inc., 2002) requires specified bi-directional links, relational labels, and definitions of both concepts and relations.

Translation Methodology

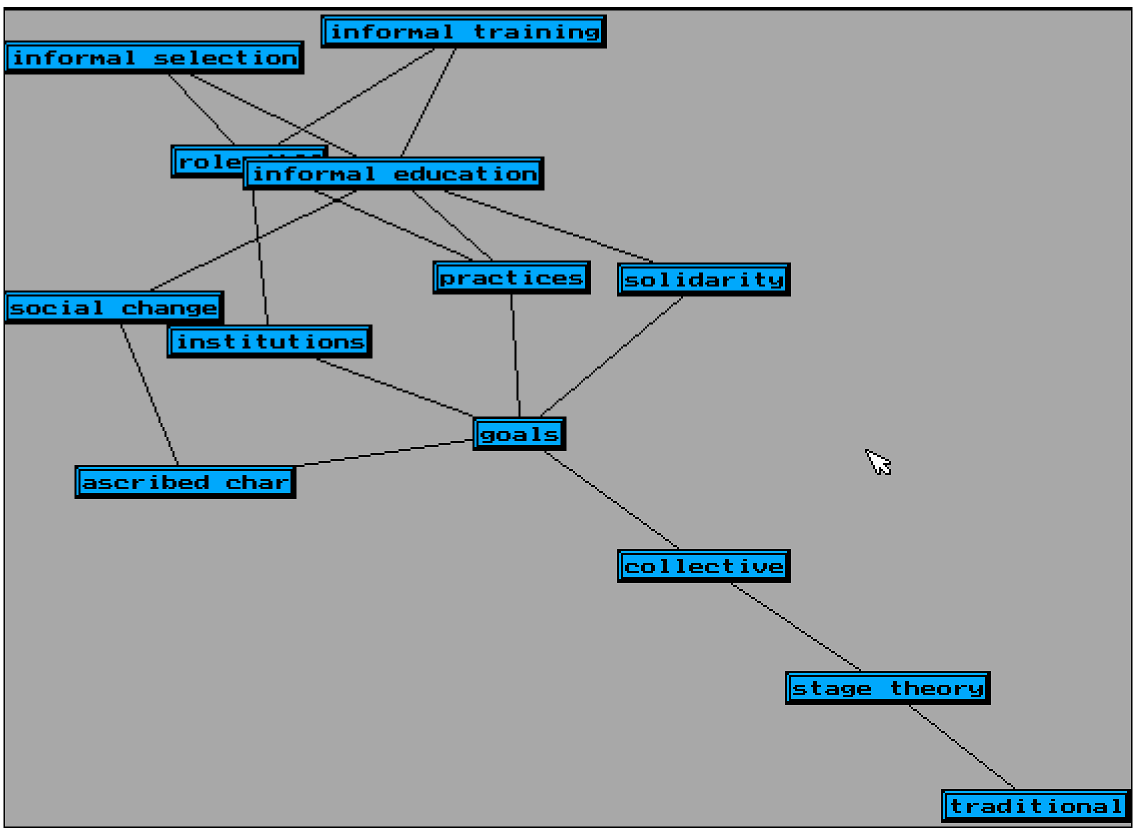
Translation from concept maps into PFnets is based upon two PFnet characteristics:

1. The graph equals the network when the weight of each link within the network equals one; thus, a graph is a network in which all links are weighted at one.
2. The length of a path from initial to terminal nodes is the sum of the number of intervening links.

Therefore, a concept map can be considered a PFnet in which all link weights equal one; that is, a graph. Thus, the length of the path between any concept map node dyad is the sum of the number of links traveled in moving from the initial to the terminal node.

PCKNOT software requires an ordered list of the terminology that it will use to label nodes. In concept map translation, this is a list of concept names. PCKNOT also requires a file that contains the ratings of all the dyad pairs. PCKNOT will accept ratings of similarities between pairs or ratings of distances. This concept map translation method uses distances: proximity ratings. PCKNOT distances can be either symmetrical (the distance from $node_1$ to $node_2$ is equal to the distance from $node_2$ to $node_1$) or asymmetrical (the distance from $node_1$ to $node_2$ is not equal to the distance from $node_2$ to $node_1$). This concept map translation methodology uses symmetrical proximities. Efficient and accurate implementation of concept map translations would require the use of a computer to count the distances between the all the network node dyads within each concept map. However, counting can be done by hand. When counting and translation are done by hand, record keeping is facilitated through a spreadsheet, entering the concept labels as vertical and horizontal matrix headings (see Figure 3). PCKNOT requires parameters for the shortest (min) and longest (max) allowable path lengths. When a dyad pair has not been specified within a concept map, it is recorded as a length that is longer than the maximum parameter. The software calculates such a dyad pair as infinitely far apart.

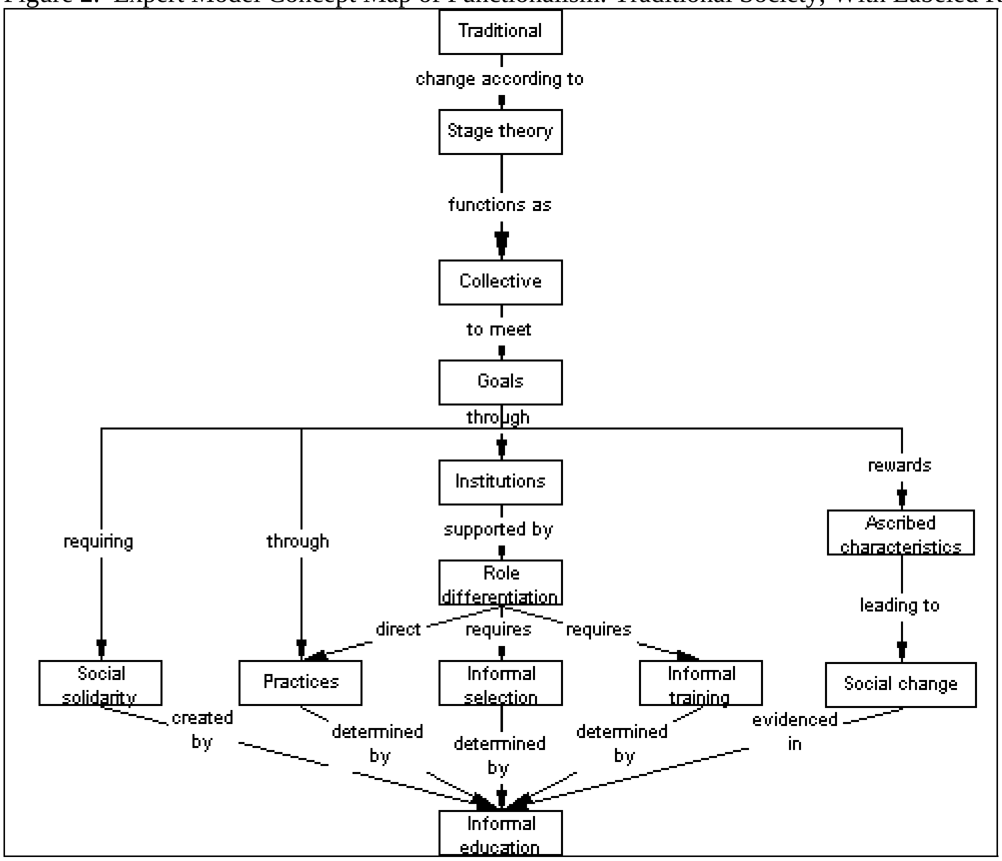
Figure 1. Pathfinder Network Translation of the Expert Model Concept Map for the Functionalism Domain (Tradition Society Segment), Constructed Within PCKNOT Software.



Participants and Data Collection

Data for this analysis were collected as part of a larger study that investigated the effect of a metaphor-enhanced, computer-mediated learning environment on learners' mental models of a targeted domain (Reese, 2003b). Fifty-seven preservice elementary teachers studying at an R-1 university in Virginia worked through a unit of instruction that introduced the educational philosophy concept of functionalism. An advance organizer designed over a concept map of the targeted domain introduced instruction for the control group. The treatment group completed a unit of instruction that used metaphor-enhanced computer interface as the advance organizer, constructed according to the Analogical Designs Model (Reese, 2003c). All participants answered a set of four, timed, extended constructed response (essay) questions. A team of two trained and domain certified raters (a) parsed participants protocols for evidence of 13 targeted domain concepts, (b) constructed a concept map for each response, and (c) collapsed each participant's set of four maps into one concept map. Each concept map represented a participant's mental model of the educational philosophy domain of functionalism. Participants' understanding of content was measured by totaling subscale scores (levels, branches, and cross-links). This type of scoring measures the richness of a learner's mental model. Results suggested that, while most learners can specify domain hierarchy (subsumption) and branches (differentiation); learners with undeveloped mental models require explicit instruction in domain integration. Those fifty-seven concept maps and the Expert Model concept map (see Figure 2) upon which the instruction had been designed and developed served as the data for the Pathfinder analyses that follow.

Figure 2. Expert Model Concept Map of Functionalism: Traditional Society, With Labeled Relational Links.



Creating the PFnets

These fifty-seven concept maps and the Expert Model map were translated into PFnets by hand, using the Proximity Matrix (see Figure 3). The 13 functionalism concept labels were used as vertical and horizontal matrix headings. The PCKNOT maximum path for this set of concepts was set as nine relational segments. When a dyad pair had not been specified within a concept map, it was recorded as 10 line segments (infinitely far apart).

Figure 4 is the concept map that was prepared by raters from protocols produced by a participant #105. Notice that concepts informal selection and social change were mentioned within the participant's protocols, but evaluated as relationally unconnected to the other 11 concepts. Therefore, the two concepts were noted on the concept map, but unconnected. PFnets calculate only for specified relational links. When concept maps are translated into the Proximity Matrix, all dyad paths to the identified but relationally isolated concepts are counted as 10, as are the dyad paths that involve non-identified concepts. Within map #105, paths involving the identified but unlinked concepts (informal selection and social change), as well as the unidentified concepts (stage theory, traditional society, informal training, and ascribed characteristics) are recorded within the matrix as 10 (infinite distances, see Figure 3).

PCKNOT reads the proximity data prepared as a simple text file. The data may be ordered as a square matrix, an upper triangle, lower triangle, or a list. The data file does not have to take the shape of the matrix or list, but data must be in the same order as they would be if in the specified shape. In this analysis, the data were entered as a lower triangle matrix. To prepare this data file, data record cells within the triangle matrix in Figure 3 were read across, by row, from left to right. Thus, the informal education X goals proximity of "2" is the sixth proximity entered. The "DATA" heading within the file contains the file name (105.prx), the identification that "distance" rather than similarity ratings will be used, the number of node/concept items (13), the number of decimal places to be calculated, the minimum distance (0), the maximum distance (9), and the order of the data (lower triangle). For PCKNOT to recognize this file, it must be saved as simple text with the file extension ".prx" (proximity). PCKNOT reads the "prx" data file and calculates the values of the PFnet. It saves the quantified output values as a text file (see Table 2). This is also read by the software and projected as a network diagram (in this case, a graph, as in Figure 2).

Analysis Through PFnets and PCKNOT

Once PCKNOT has processed a set of concept maps, the software can calculate a number of relationships that afford comparisons (a) between participants and an expert model, (b) between participants' mental models, or (c) between averaged models. The sections that follow will discuss the PCKNOT output files for each of the three comparisons. Each output presentation is followed by an interpretation and a discussion of the application of that type of analysis within instructional or research practice.

Comparison to Expert Model. Table 3 displays a snippet from the PCKNOT analysis output in which eight PFnets (109, 113, 114, 131, 143, 148, and 155) were compared to the Expert Model The first row of data belongs to PFnet 105 and the last to the Expert Model, with the remaining PFnets in between. This section highlights aspects of the PCKNOT output.

The first section of the PCKNOT output displays each PFnet's coherence, the file number assigned by the analysis, and the corresponding file name (see Table 3). Coherence measures the consistency of a network. "Coherence often correlates with expertise (or degree of learning). Very low coherence (less than 0.20 or so) may indicate that [participants] did not (or could not) take the rating task seriously" (McDonald et al., 1998, p. 2). Networks with identical links will score a similarity of 1, and those with no links in common will score 0 (McDonald et al., 1998). Within this subset of PFnets, those with the highest similarity to the Expert Model are 109, 113, and 114 (see Table 3, column 8). In general, the greater the number of total links contributed by each dyad member, the greater the possibility that the two networks will hold common links due to chance alone. The Expected links in Common By Chance is reported in the E[C] column (see Tables 3 and 5, column 6). Of these three PFnets, it is expected that 109 might have the greatest similarity to the Expert Model, due to chance alone. It is noteworthy, then, that (a) PFnet 108 registers a higher similarity than 109 and (b) PFnet 114 scores an identical similarity score, even though it contains only 5 links compared to the 16 links in PFnet 109. The point probability (the probability of exactly this number of links in common) and tail probability (the probability of at least this many links in common) both take this into account. The Tail probability "can be used as a statistical test of the similarity of two networks" (McDonald et al., 1998). That is, a significant result means it is highly unlikely that the similarity between the two networks is due to chance alone. Both the 113 and 114 PFnets are significantly similar to the Expert Model. PFnet 109 is not significantly similar. The PFnet 105 is borderline.

PFnets 143 and 148 hold no relational links in common with the Expert Model. They each score similarity ratings of "0" and Tail probabilities of "1", indicating that it is highly likely that the resemblance to the Expert Model might result as it does, due to purely chance.

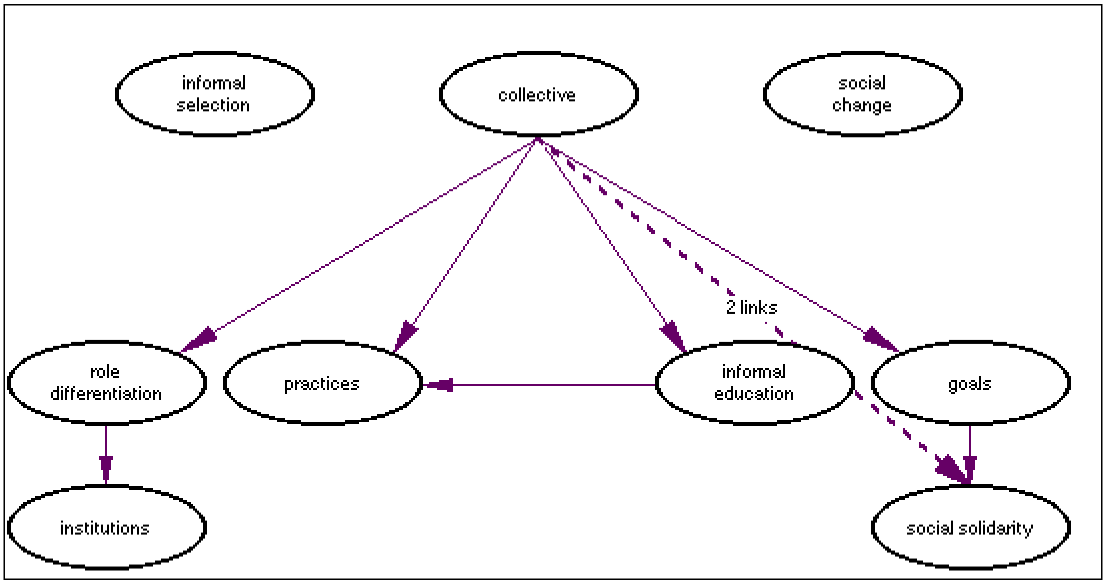
Interpreting the Results: Comparison to Expert Model. In this manner, learner and participant concept maps can be translated into Pathfinder networks and individually compared to an Expert Model. Within the group of PFnets analyzed here by similarity, post-instruction mental models held by participants 113 and 114 were the closest to the functionalism Expert Model. The correlation of each with the Expert Model (an aspect of the output file not discussed within this paper due to space limitations) further supports this conclusion. Depending upon the instructional goal at the time of data collection, the level of achievement demonstrated by 113 and 114 may or may not be acceptable. If the goal of instruction were for the learner to assimilate the Expert Model as scaffolding for further domain study, a similarity of 0.222 might be inadequate and evidence of a gap between the instructional goal and learner achievement, signaling a need for revision of instruction.

Figure 3. Proximities Matrix for Concept Map 105.

Participant number __105_____

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Stage theory													
2. Traditional society	10												
3. Informal education	10	10											
4. Goals	10	10	2										
5. Solidarity	10	10	2	1									
6. Practices	10	10	1	2	3								
7. Collective	10	10	1	1	1	1							
8. Institutions	10	10	3	3	3	3	2						
9. Role differentiation	10	10	2	2	2	2	1	1					
10. Informal selection	10	10	10	10	10	10	10	10	10				
11. Informal training	10	10	10	10	10	10	10	10	10	10			
12. Ascribed characteristics	10	10	10	10	10	10	10	10	10	10	10		
13. Social change	10	10	10	10	10	10	10	10	10	10	10	10	

Figure 4. Participant 105 Concept Map.



PFnet analyses indicate that learners 131, 143, and 148 are moving more slowly than the others in this group. Participants 143 and 148 have not constructed any relational connections that correspond to those within the Expert Model. Their PFnets contain fewer relational links than the others in the group. Results suggest that these learners require additional practice or remediation. On the other hand, while learner 131 has constructed a relationally dense model, it does not correspond to the Expert Model. This is a red flag, signaling that learner 131 may be building a non-normative model. The instructor should examine the learner's concept map; perhaps the learner has constructed an alternative model that can be substantiated. In any case, results for 131 suggest the need for a one-on-one interview. Follow-up may include instruction to uncover the characteristics of the misconception and correct it. Or, the Expert Model might require modification or inclusion of alternative versions. Thus, alternative insights provided by this learner might be incorporated into evaluation. Consideration of the 131 PFnet demonstrates how the automated functionalities of PFnet translation of learners' concept maps can facilitate an instructor's ability to monitor learner progress and evaluate instruction, affording timely and adequate instructional interventions as well as revision.

Application: Comparison to Expert Model. Results from comparison to an Expert Model can be applied within research and instructional settings:

1. For research purposes, similarity ratings can be imported into a statistical package, such as SPSS, for use in standard statistical analyses. The data used in this discussion were drawn from an experiment in which treatment learners experienced an intervention and all post-instruction learners' mental models were specified as concept maps. After (a) PFnet translation of both participant/learner concept maps and the expert map and (b) PCKNOT analysis, the similarity scores were entered into SPSS along with condition assignments. Standard statistical tests such as Pearson's product moment correlations, *t*-tests, multiple regression, and ANOVAs were used to test the effect of the treatment, as well as the interaction between interface metaphors, concept maps, and learners' cognitive characteristics.
2. Instructionally, PFnets are an ideal tool for formative evaluation, feedback, grouping, and assessment. An online system implementing PFnet translation would allow a student to enter a concept map and receive immediate feedback about its degree of comparison to an Expert Model. A teacher or administrator could query the same system; receive immediate results for an individual, group, class, entire school, or even an entire state; and use that information for formative or summative evaluation of either student progress or the effectiveness of the instruction.

Application: Comparison of Learners. The preceding section discussed PFNET comparisons between learners and an expert model. The PCKNOT software also affords comparison among learners. The correlations for this set of PFnets (not displayed due to space limitations) suggested a high similarity between the models held by learners 105, 109, and 155. A PCKNOT analysis was run to compare concept map 155's PFnet to these and four additional learner's concept maps, as translated into PFnets. The similarity between PFNETs 105 and 109 and PFnet 155 were greater than would be expected due to change alone (TlProb < .05). Thus, the similarity analysis supported the interpretation suggested by the correlations among this set of PFnets. PFnets 105, 109, 113, and 114 were more similar to PFnet 155 than would be expected due to chance alone. However, the correlations for PFnets 113 and 114 and PFnet 155 indicated little resemblance between these individual networks and PFnet 155. This means that the links that are not held in common within each comparison follow divergent paths. Perhaps this a minor difference for PFnet 114, in which the network is in its early development, containing 5 links with only 2 idiosyncratic relationships. In the case of 113, the learner's mental model is a denser network of 14 relational linkages. Thus, the lack of correspondence may be more important in comparing 113 with the 155. The models for learners 113 and 114 were both highly correlated to the Expert Model. A combination of the similarity and correlations outputs would help an instructor place these students into groups. The density of the mental model held by learner 113, the similarity of the models held by learners 105, 109, 113, and 114, and the alignment between learner 113 and 114 and the Expert Model might help all of these learners to refine their models of the domain as they continue to explore content.

Interpreting the Results: Comparison of Learners. The similarity output suggests that these learners fall into two groups: (a) learners with PFnets 131, 143, and 148 and (b) learners with PFnets 105, 109, 113, 114. When learning activities called for group work, these results would allow the instructor to quickly assess learners' progress and basing homogeneous or heterogeneous grouping decisions upon quantified evaluation of the students' mental models.

Application: Comparison of Learners. It is often desirable, and sometimes necessary, to group learners according to their understanding of a targeted domain. Traditionally, educators have used paper and pencil evaluations or informal observations to inform their decisions with respect to groupings. Computer-mediated assessment of mental models through PFnets provides an efficient method for comparing learners' understanding of a domain's underlying relational structure. The method is less biased than multiple choice or constructed response for such characteristics as writing and reading ability. Socially reticent learners are also a consideration, as it may be difficult to informally gauge mental models held by socially reticent learners. Concept maps allow these individuals the opportunity to express ideas that they might not share overtly. Here, again, since the maps are confined to terminology introduced within a specified domain, language skills are less biasing than they might be within traditional assessment instruments. So, PFnet translations of concept maps may be less biased than both informal and traditional assessment instruments while affording comparisons of learners' mental models.

Comparison and Interpretation Through Averaged Mental Models. Each PFnet is an entity consisting of nodes and the quantified links that join them. Therefore, it is easy for PCKNOT to average those relational links across a selected set of PFnets. Of the fifty-seven concept maps translated for this set of analyses, the top quartile was defined as the fourteen with the highest similarity to the Expert Model. PCKNOT can compare the average high quartile PFNET across learners and/or to the Expert Model. Figure 5 displays the layout for the average high quartile model. The PFnet layout can provide useful information to the instructor, evaluator, or researcher that goes beyond the PCKNOT similarity and correlation results. With a few clicks of a mouse, the evaluator can gain access to an aggregated map for comparison to the normative model. Comparison reveals overall strengths and weakness. For example, comparison of this average high quartile model (see Figure 5) to the expert model (see Figures 1 and 2) reveals that

1. These learners have constructed a model of functionalism in which *collective* forms the most subsuming concept. This reveals a misconception, because *traditional* and *stage theory* both subsume *collective* within the Expert Model. However, learners do recognize the role of *collective* with respect to the other concepts.
2. Within the aggregate PFNET, only four of the twelve concepts connect to *informal education*. However, within the Expert Model of functionalism, *informal education* integrates the entire domain, forming the end-link on every path within the model. It is obvious from looking at the aggregate high quartile model that even the highest achieving learners within this sample are forming models that overlook the role of *informal education*.

Application: Comparing the Average Model. As learners begin to construct mental models, comparison of an aggregate model to the Expert Model instantly reveals non-normative relational structures. Most importantly, it provides a snapshot of the collective, socially distributed model within which each individual learner would build individual understanding. Interventions can be instantly initiated and focused specifically on problematic areas by strengthening appropriate relational connections. Once again, Pathfinder analysis provides an efficient and illuminating diagnostic mechanism that allows evaluation of learner progress.

Table 2. *The PCKNOT Output File.*

PFNET C:\PCKNOT\105.PRX
13 nodes 8 links undirected 12 q (12 = n-1) infinite r 1 minimum link weight 1 maximum link weight links:

node1	node2	Weight	type
3	6	1	x
3	7	1	x
4	5	1	x
4	7	1	x
5	7	1	x
6	7	1	x
7	9	1	x
8	9	1	x

Table 3. Two *Snippets From Output File Comparing Eight PFnets to the Expert Model.*

Coherence	File#	File Name
0.994	1	105.PRX
0.988	2	109.PRX
0.955	3	113.PRX
0.913	4	114.PRX
0.928	5	131.PRX
0.903	6	143.PRX
0.998	7	148.PRX
0.992	8	155.PRX
0.783	9	Expert Model.PRX

Similarities of PFnets:

fl1	fl2	ln1	ln2	Cmn	E[C]	O-EC	Sim	E[S]	O-ES	PtPrb	TlPrb	Info
9	1	17	8	4	1.74	2.26	0.190	0.078	0.113	0.529	0.063	0.398
9	2	17	16	6	3.49	2.51	0.222	0.121	0.101	0.064	0.089	3.48
9	3	17	12	6	2.62	3.38	0.26	0.10	0.15	o.o15	0.018	5.73
9	4	17	5	4	1.09	2.91	0.22	0.054	0.168	0.006	0.007	7.12
9	5	17	14	3	3.05	-0.05	0.107	0.112	-0.005	0.277	0.637	0.65
9	6	17	4	0	0.87	-0.87	0.00	0.045	-0.04	0.3651.(	1.00	0.00
9	7	17	4	0	0.87	-0.87	0.00	0.045	-0.04	0.3651.(	1.00	0.00
9	8	17	14	4	3.05	0.95	0.148	0.112	0.036	0.209	0.359	1.48

Table 3. Note: fl1=file 1, fl2 = file2, ln1 = # links in file 1, ln2 = # links in file 2, Cmn = # links files 1 and 2 hold in common, E[C] = expected links in common, O-EC = observed – expected links in common, Sim (similarity) = common links/(total links – common links), E[S] = expected similarity due to chance alone, O-ES = observed – expected similarity, PtPrb (Point probability) = the probability of exactly this # of links by chance, TlPrb (Tail probability) = probability of this number of links or more in common by chance, Info (information) = (log2)/(Tail Probability)

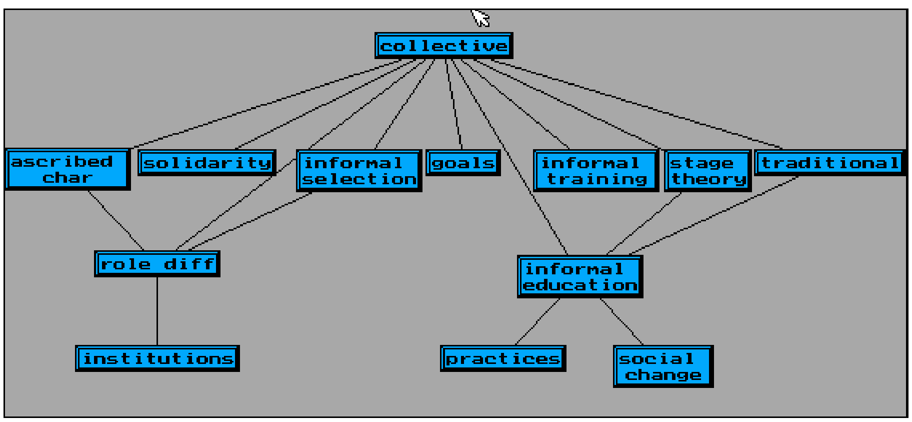
Applications Within Educational Environments

This discussion used a set of functionalism concept maps to review traditional concept map scoring and data analysis. It detailed the PFnet translation methodology and demonstrated how the PCKNOT software allows the instructional designer, evaluator, educator or researcher to compare PFnets according to their structural similarity and relational correlations. It suggested pertinent statistical analyses and illustrated how to diagnose troublesome content. In practice, an educator, instructional design team, or researcher would prepare an expert mental model (concept map) of targeted domain knowledge and translate this model into a PFnet. Students would work through early instructional activities and complete concept maps for the domain. A rater or computer would translate each student's concept map into a PFnet and run comparisons between students or between a student and an expert model. At the conclusion of instruction, the educator or researcher would repeat the process. Overall learner progress could be determined very easily through statistical analysis that compared overall or individual student results at time 1 and time 2. This discussion summarized procedures for comparing learners to an expert model, to each other, and for aggregating mental models across learners. It is important to realize that traditional concept map scoring rubrics measure the richness of learners' mental models. They do not support empirical comparisons of concept maps' relational structure. Indeed, it seems humanly impossible for an individual to eyeball a class set of concept maps and generalize relational structure across learners: comparison of two idiosyncratic maps containing 13 concepts each would require an evaluator to remember and process 78 correspondences. This hardly fits within the Magic 7 parameter (Miller, 1956).

The research reported within this paper used humans as translators, a costly and time-consuming process. Current computer-mediated technologies could afford an efficient and effortless process of information transfer and translation. Each learner could enter concept maps into mapping software that automatically processed the data. The software could translate the data to provide immediate feedback for the student. The data could also be translated and analyzed for evaluation, assessment, or research purposes, applicable to instructional design or research scenarios. As part of a suite of collaborative knowledge-sharing and curriculum development tools http://teacherbridge.cs.vt.edu), the Virginia Tech Center for Human-Computer Interaction has created a basic concept map construction tool that can be used online by students working individually or in distributed groups. Although the current version of the tool has only been used to support minimally structured brainstorming and outlining activities, the architecture provides a foundation for more advanced capabilities such as translation to PFnets. In the broadest application of the tool, servers, designers, subject-matter experts, and researchers could be housed at central locations, such as universities and colleges. Consortia of teachers, military/government and industry specialists and their university partners would chart knowledge domains. The universities would maintain the centers for evaluation, educators would teach content and interact with learners, and learners could log onto the centers to upload concept maps and receive immediate feedback.

Over a decade ago, Novak and his colleagues (Novak & Musonda, 1991) completed a twelve-year study that invented and used concept maps to chart the changes in 41 learners' mental models as the students progressed from kindergarten through the 12th grade. Today's technologies can enable researchers and educators to efficiently and effectively duplicate those accomplishments to the benefit and enhancement of learning for all students.

Figure 5. PFnet Graph for Average Network of Top Quartile (Fourteen Networks)



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Technology Integration Through Team Teaching in a Graduate Research Course

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Abstract

Two colleagues collaborated in a team teaching approach to infuse technology into an introductory graduate literacy research course. Graduate students (classroom teachers) learned to use technology such as the BlackBoard, distance learning platform, PowerPoint presentation software, and Internet resources. The team teaching approach provided the graduate students with a model for collaboration that they could apply in the research class and also in their own classrooms. There was a dramatic increase in the self-reported level of competence in the use of BlackBoard during the course, as well an increase in the self-reported level of competence in the use of Internet resources and PowerPoint .

It was Monday night, midsemester, and Professors Carolina Mancuso and Barbara Rosenfeld were team teaching their graduate Introduction to Literacy Research course. Carolina had written directives for the students on the computer, and the words were projected on the screen in the front of the room. Students were asked to write about their writing, in this case, an analysis and critique of a research article.

Students were often asked to reflect on their writing and the writing process. This was nothing new. What was new was that many students were choosing to write their reflections on the computer. This graduate literacy research course took place in the newly refurbished School of Education lab, where two dozen iMacs were available for student use. One goal of the team teaching was for Barbara to help Carolina integrate technology tools into the course. How did this collaboration come about?

When Barbara started teaching at the school, she noticed that relatively few faculty members were using technology tools in their teaching. The Dean recognized that technology was not being used optimally to benefit student learning in all classes. Accreditation organizations such as the National Council for the Accreditation of Teachers in Education (NCATE), expect to see technology being used in higher education classrooms. With an NCATE review in the near future, the department began to address this deficiency. When Barbara proposed to the Dean that she help a willing colleague integrate technology into his/her course through a team teaching approach, the Dean was very supportive. The purpose of this article is to share the experience of using a team teaching approach to enable classroom technology integration.

Barbara approached Carolina to ask about a possible collaboration; she was very enthusiastic. Both Carolina and Barbara had started teaching at the school at the same time, but didn't know each other very well. Although each had expertise in her own field — Carolina in literacy, Barbara in educational technology — they also had had some experiences in each other's fields.

Background

Collaborative efforts are fairly common in higher education, although there is an apparent shortage of literature related to collaboration among professors in colleges of education (George & Davis-Wiley, 2000). Austin and Baldwin (1992) reported that faculty collaboration has grown over the past century, negating conventional stereotypes of isolated professors conducting laboratory research or lecturing in a room full of passive students. Team teaching benefits professors by developing their pedagogical abilities, intellectually stimulating them, engaging them as self-directed learners, and connecting them more closely to the college community (Paulsen & Feldman, 1995).

Team teaching collaborations often involve instructors from different disciplines who merge their expertise in diverse ways. This collaboration paired an educational technology professor with a literacy professor. In most collaborations, the professors' expertise in their content areas is combined to provide new material for the course. In this situation, Carolina provided the expertise for the course content, and Barbara provided the expertise for infusing the technology tools.

Austin and Baldwin (1992) suggest that issues of power, influence, and professional identity can sometimes be problematic for collaborators, but these were not issues for Carolina and Barbara. In their guidelines for collaborative teaching, Cruz and Zaragoza (1998) advise of the need to establish mutual respect and trust. Carolina and Barbara's similar teaching styles and similar interests, especially their mutual love of chocolate, helped to quickly establish both respect and trust.

Team teaching provides a model of collaboration for students as well (Cruz & Zaragoza, 1998; Warmkessel & McCade, 1997). Austin and Baldwin (1992) suggest that students should be introduced to the merits and processes of collaboration as part of their professional socialization. In several studies, students expressed a positive reaction to team teaching and felt they greatly benefited from the experience (Crossman & Behrens, 1992; Davis-Wiley & Cozart, 1998). In Carolina and Barbara's class, the graduate students, themselves teachers, appreciated the convivial manner of the professors' interaction that contributed to the relaxed atmosphere in the classroom.

Implementation

Before the beginning of the semester, Carolina had already created a course syllabus with substantial content. Barbara worked on ways to enhance the existing course through the use of technology tools. BlackBoard, an electronic software platform that contains a course management system for distance learning, was introduced to the students as a way to communicate both during and outside class.

The class met in a computer lab that had 24 computer stations around the periphery of the room, and moveable tables and chairs in the center. This environment made it easy for students to engage in online research at the computers, collaborate in small groups to discuss their writing at the center tables, and then move back to the computers to edit their work and compose short metacognitive progress reports. Much of the class time was spent in this way. The two professors circulated among the students to discuss their research proposals with them. Students appreciated having two professors available for consultation.

The professors modeled collaborative behavior, and the students were asked to practice collaboration in their writing and research activities. Students read, edited, and critiqued each other's work. Rubrics were available to give students guidelines for their projects and also to ensure that they would understand the grading process. A long-term goal of the professors' collaborative efforts was that the graduate students would facilitate collaborative activities and integrate technology tools in their own classrooms.

The overhead projector in the lab was never used. The professors modeled technology use on a computer with a projection unit that was used to display the plan for the day's session, provide initial directives, and to log class discussions during every session. These logs were then posted on BlackBoard, giving all students access to past class activities. Assignments and course documents were also posted on BlackBoard, and class or individual e-mails were easily dispersed.

PowerPoint instruction was given during the semester so that those students who wished to use it to present their research projects could do so. Approximately one-third of the class opted to use PowerPoint for their final presentations.

Team Teaching and Technology Benefits

The two professors benefited from this collaboration. Carolina became more familiar with technology tools and increased her trouble shooting ability by the end of the semester. Although she had previous experience with BlackBoard, Barbara assisted her in learning how to use additional aspects of that program. She currently uses these technology tools in all her courses. Barbara learned more about the course content, particularly ways to help students reflect on the writing process by incorporating metacognitive exercises. A wonderful side benefit of this collaborative effort is that the two professors became trusted colleagues and good friends who are planning to work together on additional projects that will capitalize on their mutual strengths.

Although the main purpose for team teaching was to integrate technology tools in the course, there were additional benefits of this classroom experience for the students who observed modeling of team teaching as well as technology. Students' feedback after the course ended described their appreciation for having two professors available for discussion of their projects and for technology guidance. They liked receiving two opinions on their work, additional individual conferencing and the support that two professors could provide.

Students also gained knowledge about classroom use of technology. The easy access to the computers in the classroom lab put the research tools at their fingertips and helped them complete their assignments. They welcomed not having to go to the library to do all their research. Instruction on PowerPoint enabled students to produce professional presentations. One student reported that she had some anxiety with the technology during the course. She worried that the technology would fail and she would appear incompetent. Since the course ended, she has had additional opportunities to use the technology, (in another of Carolina's courses) and she reports feeling more confident. Another student tried to implement some of the things that were modeled in the class – her young students use PowerPoint, word processing, and the Internet to conduct research in her classroom. She also gives them opportunities to collaborate in their work. By the end of the course, this graduate student had completed six projects in her own class by asking her young students to use available Internet resources to research their topics.

Technology Use Survey

A survey of competency of technology use was administered at the beginning and again at the end of the semester using a 4-point Likert scale (Don't know anything, Know a little, Somewhat competent, Very competent). There was a dramatic increase in the self-reported level of competence in the use of BlackBoard during the course. At the beginning of the semester, 15 students (out of the 18 who responded to the survey) reported that they didn't know anything about BlackBoard. At the end of the semester 11 students (out of the 17 students who responded) felt somewhat competent and 3 felt very competent in their use of BlackBoard. By the end of the course, no students reported that they didn't know anything about BlackBoard. (Please refer to Table 1.) Questions about the use of automated library resources and PowerPoint also show that students felt more competent at the end of the semester than they did at the beginning, but the increase in self-reported competence was not as dramatic. (Please refer to Tables 2 and 3.)

Table 1. *Response to BlackBoard Question on the Survey of Technology Use*

What is your level of competence with the use of BlackBoard?	Don't know anything	Know a little	Somewhat competent	Very competent	No response to this question
Beginning of semester	15	1	1	0	1
End of semester	0	3	11	3	0

Table 2. *Response to Automated Library References Question on the Survey of Technology Use*

What is your level of competence with the use of automated library resources?	Don't know anything	Know a little	Somewhat competent	Very competent	No response to this question
Beginning of semester	7	7	2	0	1
End of semester	0	3	11	1	2

Table 3. *Response to PowerPoint Question on the Survey of Technology Us*

What is your level of competence with the use of PowerPoint?	Don't know anything	Know a little	Somewhat competent	Very competent	No response to this question
Beginning of semester	6	10	2	0	0
End of semester	3	6	6	2	0

Ideas for the Future and Concluding Thoughts

There were other technology activities that were planned during the semester, but they did not transpire. The professors had hoped to have students try round robin editing (where they would change seats and edit each other's work on the computer), but the time was unavailable to implement this technique. Another idea was to try editing by exchanging files on BlackBoard using the small group discussion board. This also did not occur. Another way that technology can help student research is by using videocameras to tape teachers and students in the classroom. These are all possible activities for the future.

The administration was instrumental in promoting this innovation. The Dean supported the team teaching idea and permitted it to occur. Administrators have a key role to play in fostering effective collaboration by allocating discretionary resources and shaping supportive policies. Rewarding and recognizing collaborative achievements both publicly and privately can also stimulate collaborative work (Austin & Baldwin, 1992; Paulsen & Feldman, 1995).

Technology integration is an important standard in many educational organizations. When faculty are asked to implement technology tools in their classrooms, administrators should offer the support necessary for each faculty member. Team teaching is an innovative way for knowledgeable faculty to help their colleagues and it should not be overlooked.

One student's final thoughts on the class provide a testimonial to its value and significance:

> The research class that I fortuitously landed in provided me with a fresh perspective on teaching, concrete collaborative methods of completing projects and a supportive learning environment. The instructors…truly were a dream team. They demonstrated, planned or not, how well teaching to strengths and being supportive to new attempts can create a strengthened instructor base, and in turn, a richer learning environment.
>
> The technology aspect of the class was complimentary to its research counterpart. It was useful to have the computer lab as the classroom. The convenience of access to technology, along with guided instruction and modeling proved invaluable to the completion of class assignments. The slide-show lessons were especially useful as they provided us with the means of producing a professionally appealing presentation….
>
> In the area of team teaching, the instructors…allowed for increased conferencing time on the discussion of projects, technology guidance, and a shared therefore lighter workload (hopefully). After all, a happy instructor is a happy marker, creating a happy student….Thanks to their fearlessness of team teaching, I am willing to give it a try in my own classroom….Hopefully there will one day be enough money and compatible people for team instruction to be the norm rather than the exception.

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Supporting performance in the teacher education system

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Abstract

The purpose of this case study was to examine a teacher education system relative to the degree of performance support for the use of technology to support learning. Degree of support was measured by the presence of factors such as clear expectations, feedback, tools, rewards, incentives, motivation, capacity, skills, and knowledge within the system. Major stakeholders within the teacher education system at the target institution included teacher education faculty, student-teacher candidates, and cooperating teachers in local schools. Several areas of performance support were found to be required within and across stakeholder groups. Results of the study are discussed with a particular focus on the degree of alignment of supports across the system. Recommendations for the allocation of system resources related to technology integration are also discussed.

Background

Public schools in the U.S. have been the target of reforms and federally-sponsored programs and initiatives almost since their inception. These initiatives focus on aspects of schools that range from the expansive, such as total system reform, to specific areas of focus such as faculty development, and curriculum and course management (need ref ?). Moreover, federally sponsored reports such as the Secretary's Commission on Achieving Necessary Skills or SCANS (1991) and most recently, Partnership for 21st Century Skills (2003).

A common thread between all of these reports has been a focus on what students should know and be able to do upon graduation. SCANS and Workforce 2000 (Johnston & Packer, 1987) emphasized learning to learn, problem solving with visual tools such as graphs and charts, and working collaboratively on teams. The Partnership for 21st Century Skills report included digital literacy and the use of technologies for the purpose of communicating and collaborating. Another recent technology-oriented focus of school reform at the federal level has been in the area of integrating technology into classrooms through a variety of programs, such as the Technology Literacy Challenge Fund and Preparing Tomorrow's Teachers for Technology (PT3).

Given these and other reform efforts at the state and school district level, why has the K-12 educational system not been successful in integrating technology in order to provide students with those necessary skills? Perhaps a look at the progression of professional development efforts related to technology integration will help to answer this question. These efforts got under way in earnest in the early 1990's. At that point in time, funding and related activity concentrated on getting the necessary hardware into the schools**.** The overarching problem in this phase was that teachers were not being trained on how to use the equipment. The mid-1990's, or phase two, saw a change in the approach of integrating technology into our schools. Many of the new funding programs, including the Technology Innovation Challenge Grant Program and the Technology Literacy Challenge Fund, stipulated that professional development should account for a major portion, at least 30%, of the funding while the remainder was used for acquiring equipment. This was done to ensure that educators would have the ability to use newly acquired computer equipment so it would not sit dormant in the classrooms and schools as in the previous phase. In other words, educators were taught the necessary skills, leading them on a path to become technology literate.

We have now reached a third phase of technology integration reform movement, in which educators have either decided it is not worth the effort to integrate technology or they have adopted technology. For those who have adopted technology, many are not truly integrating technology but rather using it on a superficial level (Becker, 2001; Education Week, Technology Counts 2003), as is allowed by their skills, and the fact that they are technology literate but not yet "technology fluent". These educators have reached a point where they are ready for further training, information, and most importantly, knowledge that incorporates pedagogically-sound principles for integrating technology correctly, efficiently, and effectively.

During this phase of the reform movement to integrate technology it is time to look at the situation from a broader perspective. Instead of trying to go for the "quick fix" approach for perceived problems at the K-12 level, perhaps we need to look at the larger educational system, including pre-service teacher candidates and the curriculum they experience, as well as those that instruct them, the teacher education faculty at colleges and universities.

Several recent reports (Smerdon, et al., 2000; Moursand and Bielfeldt, 1999; Panel on Educational Technology, 1997; Office of Technology Assessment, 1995) have looked at the use of technology by faculty in teacher preparation programs. Findings related to their use of technology has shown “that technology is not central to teacher preparation in most colleges of education. Problems include limited use of technology in teacher education courses, an emphasis on teaching about technology rather than teaching with technology, lack of faculty modeling, insufficient funding and faculty professional development opportunities, and lack of emphasis’ on technology in students’ field experiences (Lehman & Richardson, 2003)”.

While the development of skills to use technology is necessary to supporting its use, it is not sufficient. Faculty members in the teacher education system and teachers within K-12 systems have historically been introduced to new technologies using a faculty development model.

This approach assumes that skill development training will produce the desired result, use of technology in the classroom, but ignores non-training issues such as incentives (Education Week, 2003).

To address the development and resource requirements of the faculty in a teacher education program, a performance support approach has been found to be appropriate (Wedman & Diggs, 2001). In this study at the University of Missouri, faculty within the teacher education program were surveyed regarding perceived barriers to technology use. Several barriers were identified including unclear expectations for the use of technology, inadequate tools and equipment, lack of incentives promoting the use of technology, and lack of knowledge about how to use technology.

A performance support approach implies that multiple elements within a performers work environment combine to support excellent performance. These elements can serve as enhancers of performance as well as barriers. Performance support system models have been used to analyze problems and opportunities in organizations for many years (Douglas & Schaffer, 2003). Models have been developed to study workplace behaviors and management of contingencies in the environment (Gilbert, 1968), as well as the horizontal and vertical interrelationships between people and processes across organizational functions (Rummler & Brache, 1995). There are many similar models described in the human resources, organizational development, and performance improvement literature (see Schaffer, 2000 for a review of models).

In the current study, the performance pyramid developed by Wedman & Graham (1998) was used to identify the presence of support for the use of technology in K-20 classrooms by various stakeholders (see Figure 1). The performance pyramid is composed of eight elements that are believed to significantly impact the ability of a performer to produce valued results in the workplace (or classroom). These elements include:

- Vision – An organization’s stated mission, goals, and strategies related to achieving superior results and being a value-added member of society. A critical aspect of creating an organizational vision is the alignment of mission, goals and strategies throughout the organizational structure. For example, a university strategic plan is set by the president and board of trustees. This plan is then cascaded throughout the organization. Colleges, schools, depts., programs, faculty, and professional staff are then expected to set their own strategies that are aligned with the university strategic plan.
- Culture – As the organization attempts to carry out its vision, the members of the organization codify knowledge, rules of engagement, modes of communication, norms, approaches to problem solving, etc. which all add up to its culture.
- Expectations & Feedback – To perform a task or achieve a goal, it is necessary that performers know precisely what is expected in order for the task or goal to be achieved. Expectations may be a set of guidelines, a specified level of performance measured quantitatively or qualitatively. This measurement of performance is then fed back to performers to let them know how well they are doing relative to the goal. Without feedback, performers have little information about their current performance that will help them improve. Setting expectations and providing a feedback mechanism is primarily the responsibility of leadership and/or management.
- Tools, Information, Processes – Critical tools, information and processes related to performing tasks must be in place to ensure that performance is optimized and performance expectations can be met. Performers may have knowledge and skills about how to perform but without up-to-date tools and information or clear processes it will be difficult to perform to expectations. Making sure tools information and processes are available to performers is primarily the responsibility of leadership and/or management.
- Rewards & Incentives – Monetary and non-monetary rewards and incentives for performance of critical tasks will greatly enhance the likelihood of improved performance. Performers in organizations expect to

be compensated fairly for contributions to the accomplishment of organizational mission and goals. Rewards and incentive systems are closely linked to individual motivation. Putting rewards and incentive systems in place is primarily the responsibility of leadership and/or management.

- Desire and Self-concept – Desire is the extent to which performers buy into the vision, mission, goals, expectations and rewards structures as evidenced by their desire to perform. In essence, desire to perform is the "consequence of the values, background and work habits an individual brings to a situation" (Wedman, 2003). Self-concept relates to one's ability to see themselves performing a task. This ability can be enhanced by the presence of role models and by putting performers in situations in which performance is enabled.
- Capacity to Perform – Humans have different capacities to perform roles or tasks and roles or tasks require specific capacities. Physical and mental capacities along with cognitive style required by a task must be matched with the individual. For example, designing web pages requires the capacity to visually discriminate on-screen icons. This task may also require the capacity to sit for long periods at a time. Accommodation may be made to work around capacity limitations but accommodations may also require the presence of other types of performance support such as skills or tools.
- Knowledge & Skills – Different tasks require varying degrees of knowledge and skills. Knowledge and skills are what people should know and do to be able to perform a task. Education is often thought as supplying knowledge or ability to solve novel problems, and training is geared toward development of skills related to a specific task but these concepts tend to be mitigated by experiences, background and prior knowledge performers bring to a given situation.

Figure 1. Performance Pyramid (Wedman & Graham, 1998)

Research Questions

To more fully understand the complex issues surrounding integration of technology into classrooms, a teacher education system at a large Midwestern university was studied. The following research questions were examined: What performance support factors have the greatest impact on technology use by teacher education system stakeholders? What factors limit or serve as barriers to effective use of technology in the K-12 classroom? What factors in a teacher education program limit or serve as barriers to effective preparation for use of technology to enhance learning?

To study barriers to technology use in the classroom, we will partially replicate and build upon a study done by Wedman & Diggs (2001). Their study focused on barriers to technology use within the teacher education program at the University of Missouri. While they studied barriers for teacher education faculty, this study also examines teacher education students (pre-service) and in-service teachers in area K-12 classrooms.

Method

Stakeholders

Teacher education faculty in the Department of Curriculum & Instruction within the School of Education, students in teacher education classes were participants, as were cooperating teachers at area K-12 schools. Twenty-three faculty members out of the 46 within the department completed the survey, and 6 members of the faculty were interviewed. A total of 21 students completed a questionnaire and a total of 6 were interviewed. Twenty-two cooperating teachers (CT) completed the questionnaire and 1 was interviewed for the study. All participants volunteered for the study.

Survey

Questionnaire and interview items were based on the Performance Pyramid elements (see figure 1) and adapted from Wedman and Diggs (2001) Technology and Leadership System Survey and the Technology Leadership Support System Interview for teacher education program faculty. Specifically, companion survey instruments were developed for student teachers and cooperating teachers. Additionally, interviews included items related to 'culture" of the organization as it relates to support of technology use. Questionnaires were administered on the World Wide Web thus it is difficult to calculate an exact return rate. Faculty respondents represented 50% of the teacher education faculty, student teachers represented approximately 15% of the active student teachers in the semester data was collected, and participating cooperating teachers represented 23 schools across the state that partner with the university to train student teachers.

Findings

Questionnaire data collected for each of the stakeholder groups is shown in Table 1. The percentage of respondents within each stakeholder group indicating the presence of each type of performance support is shown. The percentages that are bolded are thought to indicate a particularly low level of performance support for the stakeholder group. Across the teacher education system, performance support elements that were most lacking include:

- Rewards and incentives for the use of technology was the most significant barrier for pre-service and in-service teachers; university faculty also saw this as one of their major barriers.
- The presence of feedback regarding the appropriateness of current technology use was a big outage for faculty and students in the university. In-service teachers also rated this as one of their most significant barriers.
- Expectations for technology use in the classroom was a barrier for faculty and pre-service teachers within the university.
- The degree to which the physical environment within classrooms and labs supported technology use was a barrier for faculty and pre-service teachers.

Pyramid Block	**CT n=22**	**FAC n=23**	**STU n=21**
Skills & Knowledge	76	**53**	81
Capacity	71	88	76
Motivation	86	88	71
Rewards & Incentives	**5**	**28**	**9**
Access/Phys. Env.	95/71	65/**56**	95/**52**
Process support	62	72	**33**
Feedback	**33**	**18**	**10**
Expectations	62	**41**	**28**

Table 1. *Presence of performance support for use of technology across stakeholder groups.*

Faculty interview data supported the survey findings. For example, the faculty interviewed (n=6) all pointed to the PT3 grant at the university as an opportunity that provided not only training in skills and integration, but also as offering incentives and reward. However, this was seen as a temporary opportunity, and several mentioned that they were unsure of what would happen when the grant ended, with at least 2 predicting things would return to the "status quo". In terms of feedback and expectations, the faculty discussed that while technology was not a requirement it was encouraged and valued, with no detriment to their careers if technology was not employed within the curriculum. Several also indicated that while feedback was informal they did perceive themselves as receiving recognition for their use of technology.

In relation to organizational culture and vision, the faculty indicated that they felt there was a strong value associated with technology at the university level, in accordance with the university's strategic plan developed over the past year. They also indicated that at the departmental level there was a strong vision, mostly associated with the Department Head, who encourages and values technology. However, it was also mentioned that their had been an interim Dean in the School until the current academic year, thereby putting on hold the alignment of the School of Education's strategic plan with that of the university's.

The student interviews (n=6) reflected a different picture. In terms of the culture in the teacher education program, responses reflected a continuum of experiences; from "no technology is expected or exists" to "technology is always utilized". In terms of the vision, they indicated that basic skills were encouraged and/or a comfort with technology, but not much beyond that. In relation to the survey questions, the student interview data supported the survey findings, reaffirming their need for support related to technology integration and skills (skills and knowledge), a lack of rewards or incentives, a need for feedback and a better understanding of what is expected of them in terms of technology use.

Open-ended Survey Questions

At the end of the surveys given to the cooperating teachers, the pre-service teachers, and the faculty, each was asked what they about the roles o the other groups in relation to preparing the pre-service teachers to integrate technology. For example, the cooperating teachers were asked what role, if any, they thought they should play to help pre-service teachers use technology in the classroom. While the responses ranged, most (n=18) indicated that they thought they should play an active role through modeling, discussing issues, and developing lessons. As one cooperating teacher stated:

> I think it's important to help student teachers incorporate a variety of technology options during the student teaching experience. As she observes me using technology, she gains more knowledge and confidence in using technology on her own.

On the other hand, some of the cooperating teachers also mentioned that the pre-service students sometimes know more about technology than the teachers, leaving them out of the technology loop. As one cooperating teacher explained, "Since I do not feel comfortable with technology, I do not feel I would be beneficial in demonstrating this." Moreover, the cooperating teachers indicated that while they should play a role, teaching the pre-service teachers how to use technology was not among them; instead, they feel that is the responsibility of the faculty.

When the pre-service teachers were queried on the same topic, what role their cooperating teachers should play, almost all (n=19) all indicated an informative role for the cooperating teachers , such as modeling technology integration, discussing what has worked for them in their classroom, discussing when to use it and how to use it effectively. Also, as expected, several (n=4) indicated that the technology resources were so minimal that their cooperating teachers couldn't really help them in this regard.

In response to the role of the faculty in the teacher education preparation program at the university, the pre-service teachers were split, with approximately 50% saying that they learned many skills and techniques in their teacher education program. However, the majority of those students also cited the required educational technology course as the basis of their experience with integrating technology. As one student shared, "I wasn't aware of faculty helping me use technology other than when I took [the required educational technology] course." Similarly, another student replied "They should have integrated technology into our classes if we are required to integrate it into our lessons." As several of the students went on to explain, the required educational technology class and the parallel courses that modeled technology occurred during their first year of teacher preparation, and then technology disappeared for the most part, leaving them frustrated.

Interestingly enough, when faculty were asked about the possible role of the cooperating teachers in relation to technology integration and pre-service teachers, many of the faculty gave responses indicating that technology wasn't readily available in the schools, which was counter to what many of the cooperating teachers indicated. Overall, however, faculty appeared to mirror the same expectations as the pre-service teachers in terms of responsibilities of the cooperating teachers, including modeling behaviors and allowing for opportunities. Finally, it is also important to mention that several faculty (n=4) indicated that they would need to have a better idea of what occurred in the schools before they could respond to this question. These discrepancies could indicate a breakdown in the educational system in terms of expectations, and even preparation. For example, one faculty member stated, "…we need to find out what currently exists within their schools and how we can build upon it. It is very possible they are doing great things and we, faculty, could learn from them."

Conclusions and Recommendations

Several barriers to technology use in a teacher education system were identified during this study. The first research question in this study focused on the whole system and barriers common to all stakeholders. Major barriers were a perceived lack of rewards and incentives, and insufficient feedback regarding the level and type of technology use relative to expectations. On the surface it is easy to dismiss rewards and incentives as a typical complaint within underfunded educational systems. However, the combination of insufficient feedback and lack of reward and incentives suggests a more fundamental problem. The lack of feedback related to technology use implies that expectations for it use are not clearly understood. It is difficult to reward performance that is not measurable or where the results are not clearly observable. Stakeholders across the teacher education system in this study appeared to have a relatively strong desire to use technology in the classroom and were receiving training on the use of tools, but many still felt unsure about how much integration they were to do and how often they were to do it. Without a strong mandate from leadership, i.e. principals, department head, deans, presidents, a "volunteer" level of technology integration can be expected.

Several cooperating teachers in the K-12 schools expressed a sense of ambivalence about the degree to which they were responsible for helping pre-service teachers integrate technology. From a performance support point of view, this ambivalence could be rooted in both organizational and personal issues. The degree to which a district and principal put forth a vision that includes technology integration and has a specific role, expectations, and goals for teachers in that integration helps explain the level of buy-in to such integration by teachers. A given teacher's level of skill or knowledge related to technology and a related desire to engage in technology integration activities helps to explain the level of resistance to assisting student teachers in the classroom.

Faculty with the role of preparing student teachers have similar organization and individual challenges. The degree to which the university, school, and department visions are aligned with respect to technology will to a large extent explain how effective local leaders are in making expectations for technology use clear, developing goals that allow for meaningful feedback regarding progress, and rewarding performance that appears to support the organizational vision. Faculty had a sense of the organizational vision as it related to technology use but did not see a strong connection between the vision and performance expectations and rewards structures. In effect, there was little relationship between tenure and promotion and technology integration in the minds of faculty.

Student teachers are stakeholders and customers within this system. The organizational level supports they are dependent upon for success are the same supports that the faculty and cooperating teachers depend upon. Thus students' success at integrating technology is quite interrelated with the success their university and cooperating teachers have had within their respective institutions. The teacher education classes they attend collectively serve as models for their future classrooms. Students in this study were not sure what level of technology use is expected and when they are doing what is expected. The lack of feedback related to level and appropriateness of technology use and related lack of rewards was thus completely misaligned across the system. Students had a unique barrier in the lack of process support for technology use. Other stakeholders had access to a technical support person who had the job of making sure teachers technology requirements were supported. Students have no technical support related to technology integration and are somewhat dependent upon teachers or experts outside of the teacher education system to support them from a technical point of view.

The results of this study show the importance of thinking systemically and supporting performance across stakeholder groups. Support of technology integration in schools too often focuses on acquisition of hardware and software, and associated skills training. It is recommended that a broader definition of technology integration be considered that goes beyond digital literacy to digital fluency with a focus on learning to learn with technology tools. From a strategic resource allocation point of view, performance support models help to elucidate specific ways to target resources in order to optimize technology integration.

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Instructional Designers' Perceptions of Their Communities of Practice

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Abstract

We presume that models and theory in instructional design inform professional practice, but theory has not been consistently built from the professional experiences of instructional designers. This study draws on the observations of five instructional designers who discuss their professional identities, their communities of practice and their roles as agents of social and institutional change. This study is embedded in two theoretical positions: instructional design as a social construct that is expressed in professional communities of practice and critical pedagogy, in which designers act as agents of social change

Introduction

Instructional design is richly informed by theory, and much of the theory is practical and applied. Instructional designers have been trained in the theoretical underpinnings of their practice, and they use theory to inform their work. But much of the extensive work describing theoretical models of instructional design (ID) has not been drawn from the practice of the instructional designer and, consequently, instructional design theory is not grounded in practice. It is important to draw on the professional experience of instructional designers, their personal understanding of and values related to learning with technology, and the relation of these to their practice.
This is the first in a series of studies devoted to understanding roles played by instructional designers as agents of social change in higher education. This study is a preliminary investigation of the professional identities of instructional designers and their communities of practice. Accordingly, the study had three principal objectives, stated here as key questions:

- How do instructional designers describe their professional identities; that is, where do instructional designers draw their identities?
- Where do designers find communities of practice, and how do instructional designers participate in communities of practice?
- How do instructional designers describe their roles as agents of social change and transformation?

Context Informing the Study

This study is embedded in two theoretical positions: instructional design as a social construct that is expressed in professional communities of practice and critical pedagogy, in which designers act as agents of social change. A cultural shift has been occurring over the past decade in education and instructional design – a shift towards environments and approaches based on the ideas of social constructivism. In this worldview, learning is situated in rich contexts, and knowledge is constructed in communities of practice through social interactions. Cobb (1996) argues that knowledge is not held objectively, but is unique, wholly subjective, and passed on by establishing common ground between the knower and the learner. This common ground must embrace interests and personal values, which requires a sharing at both the socio-cultural and the cognitive levels (Ewing, Dowling, & Coutts, 1998, p. 10). Constructivists are interested in prior experience, but prior experience that is shared, through conversation, negotiation, and construction of new knowledge products. In other words, an individual's (designer's) practice, to which self-reflection is critical, will reflect his or her values and belief structures, understandings, prior experiences, construction of new knowledge through social interaction and negotiation within professional communities of practice.

Communities of Practice

The theoretical grounding for this study resides in the literature of communities of practice. We suggest that understanding communities of practice is central to the notion of a social constructivist view of the practice of instructional design. There is a rich and growing theoretical literature that explores essential characteristics of communities of practice (Alani, Dasmahapatra, O'Hara, & Shadbolt, 2003; Palloff & Pratt, 1999; Schwen, Kalman, Hara, & Kisling, 1998; Schwier, 2001; Wenger, 1998). We presume instructional designers use communities of practice to learn, question, critically analyze, reflect on, and negotiate their understanding of this complex field of study. At the same time, we know very little about instructional designers' communities of practice.

Social Change Agency and ID

We suggest that instructional designers are actually engaging in a process of professional and personal transformation that has the potential to transform the institution. Rogoff (1990) argues that participation in learning hinges on communication between people in a group, in terms of shared understanding or shared thinking. Glaser (1991), Ewing et. al. (1998), and others (cf. Jonassen., Dyer, Peters, Robinson, Harvey, King, & Loughner, 1997; Kanuka & Anderson, 1998) believe that learning is most effective if it is embedded in social experience, and if it is situated in authentic problem-solving contexts entailing cognitive demands relevant for coping with real life situations, and occurs through social intercourse. The instructional design process, in which designers and others develop new ideas and understandings through conversation, may be a form of cultural learning or collaborative learning. These collaborations, however formed, may express themselves as communities of practice.

Research Protocol

This study was constructed as a disciplined inquiry using a grounded theory approach, and the research protocol was designed to actively engage designers in the research process. Sources of data included interviews with instructional designers, email, and group meetings and/or focus groups. Primary data were gathered though semi-structured interviews with five individual instructional designers from four different organizations, each of which lasted from one to three hours in duration, follow-up conversations using email, and from a focus group of eight instructional designers at one organization that lasted approximately one hour. One participant was unavailable for a face-to-face interview, so that interview was conducted via email. Initial interview questions were developed based on variables drawn from literature on communities of practice and knowledge management. Additional questions were developed using the language of participants to add detail and clarify their meanings.

Results and Discussion

The research questions defined three areas of investigation, and they were used to help organize semantic networks from the data. Themes emerged from the data, and they created three large clusters for analysis: identity and instructional design, instructional design communities of practice, and social change agency of instructional designers. The results are listed below without elaboration, given the limitations of the space available for this report. References to supporting data from coded interviews are listed by participant pseudonym and coded item, such that (Deborah:54) refers to the 54th coded item in Deborah's transcript.

Identity and Instructional Design

Identity is an important part of any community of practice. It embraces a sense of shared purpose. A successful community needs to have boundaries that define its recognized focus. Sometimes the moniker "instructional designer" is adopted by an organization before that identity is defined, as organizations create the positions and anoint employees with the label. We speculated that people create identities from their experience and background, and in professional communities they draw on institutional culture, professional literature, professional organizations and reflection to understand the boundaries of their practice.

The participants made several comments that suggested that ID is an area struggling for identity, a positive image and respect. First of all, there is the issue of whether ID is objectivist and hard-nosed. Add to this the expressed concern that ID is expensive and a process that actually slows down organizational efforts to produce resources (Deborah:63; Deborah:52; Eric:41) and worry from instructional designers about the importance or consistency of their contributions (Allen:72; Allen:80; Barbara:45). Does this mean that IDers don't understand the types of contributions they make? No. Instructional designers were able to identify places where they had a personal impact on social change (Deborah:54), or where they brought particular skills or strategies to bear on projects (Eric:37; Allen:82; Allen:83). But instructional designers also recognize that their worth may be misunderstood, and that they will need to be able to respond to challenges from clients about their value.

There seem to be several paths people can take into the profession, only one of which is through professional programs, and this may contribute to the disquiet about identity. An examination of the quotations coded to "experience" reveals that experience is a path to training and the profession as often as it happens the other way around. ID is a profession that doesn't require credentials to practice, and there is no impediment to gaining experience. People come to the profession from many different walks of life, and are "hooked" by the experience of designing something successfully. This often leads them to pursue professional training to understand the processes underlying successful performance.

Teaching background seems to be particularly influential. Several participants commented on the importance of teaching background to the practice of ID—that it lends a valuable perspective to the practice of ID. There is a hint that a teaching background, and perhaps other careers. are super-ordinate to ID theory or experience, that teaching background not only informs the practice of ID, it is somehow more important

It is also interesting to note the tone of the statement "...it wasn't just some instructional design theory, and it wasn't just based on instructional design experience." The ID identity is wrapped up in value statements about previous positions or careers. In fact, other instructional designers on the team were identified by their earlier roles, and there is the implication that these positions impinged importantly on their identities as instructional designers. But it is just as significant that teaching experience alone wasn't seen as adequate preparation for instructional design. Other experiences—as a student, in learning theory, with experienced designers—are all seen as contributing to ID performance (Barbara:18).

Institutional Culture

Part of instructional designer's identity is embedded in the context of the institutional culture in which ID is practiced. The culture of an institution carries with it very strong embedded values and a unique identity. Quite by accident in this study, three of the participants worked in university settings and three had worked or still worked in organizations devoted to designing instructional courses and resources for open learning. One person had recently left an open learning organization and moved to a university setting. It was quite apparent that the cultures of the organizations were influential, and that members of the organizations thought a great deal about the implications of those cultures on the practice of instructional design. (Barbara:5).

How do the cultures differ? For one thing, the open learning organizations seem to pay much closer attention to the audiences, perhaps because they are viewed as customers of their products. (Barbara:10) By comparison, university settings seem to emphasize content in design. (Barbara:12) These instructional designers also reported finding a more business-like, project-centred ethic at work in the open learning settings. (Barbara:32) This was evidenced in comments about the close attention paid to project deadlines, the union mentality about work hours, and the efficiency of housing production and instructional support services in the same building as instructional design.

University settings were viewed quite differently. Services were seen as more distributed and separated at the universities described by these participants. University culture was viewed as no less demanding, but the atmosphere and expectations were quite different. Universities seemed to adopt a more contemplative, scholarly approach to instructional design, and expectations emphasized research and best practice. (Barbara:33; Eric:57) Reading these accounts, it is possible to conclude that university life is leisurely and casual, whereas open learning settings are more corporate and demanding. This would me misleading. The workload demands were seen as roughly equivalent, but the time commitment was interpreted differently in the two settings. Open learning organizations ran on strict workday schedules (Barbara:34), whereas universities had little concern or respect for the difference between personal and professional time. (Barbara:37) But the most important conclusion to be drawn from this is not the direct comparison of a business model and university model of ID cultures. It is appropriate to reiterate that these observations are highly contextual, as are all of the observations in this report. There is no single university structure, nor is there any single business culture that can be generalized. Nevertheless, the comments harvested here point out very eloquently that different ID cultures do exist in various organizations, and these cultures influence the communities of practice.

ID Professional Organizations, Literature and Reflection

Professional organizations play an important role in nourishing ID communities of practice, but it appears to be an indirect relationship. By sponsoring conferences, contribute to designers' communities of practice. When asked about professional organizations and conferences, participants indicated that they were important for making personal contact with individuals, often for the purpose of making virtual contact with them later. But as important as face to face contact is, conference attendance is sporadic due to the high cost of travel and attendance. And to foreshadow an observation we will elaborate later, professional organizations are formal structures, whereas ID communities of practice are largely informal.

When asked about ID literature reviewed regularly, participants mentioned web-based resources and references. One mentioned two professional journals, but it is apparent that these designers more often look to the web for professional guidance. Formal, printed literature held no particular prominence in the immediate attention of these designers as a more legitimate source of trustworthy advice than web-based resources. But these designers use professional literature and resources, often to reflect on projects underway.

Reflection informs the professional identities of instructional designers, and consequently their communities of practice. Although nobody mentioned using a formal approach to reflection such as journaling, most suggested that they engaged informally and regularly in professional reflection. There was also mention of group events and professional development opportunities that stimulated reflection.

In the final analysis, instructional designers seem to have a clear idea of who they are and a great deal of respect for what they can contribute. That clarity and respect is not shared by the organizations they serve. Instructional designers come from many professional walks of life, and there doesn't seem to be a central rallying post for them. They appear to be very competent people caught up in doing a good job. They attend conferences, read literature (mostly on the web), and reflect informally on their performance and how to improve it. But the focus is close to the ground, for the most part, not in the clouds.

Instructional Design Communities of Practice

Collaboration with other designers is a key element in developing a community of practice, and before starting this research, we assumed that instructional designers would be working in very solitary, very isolated settings. We were wrong. Collaboration is identified as important to instructional designers (Allen:17; Barbara:36) for a number of reasons and they actively seek convenient opportunities to engage others. It expands the pool of experience on which designers draw, and there is evidence that people include collaboration as part of the social fabric of the organization.

Communities of Convenience

It is quite apparent that Communities of Practice, as defined by participants, were born of convenience more than through formal structures, encouragements or agendas. Every participant in the study indicated that their communities were informal and convenience seemed to be a core issue in their formation.

They were also often tied to social gatherings as predictable as a coffee klatch (Barbara:36) or as inventive as an exercise group (Deborah:42). The notion of convenience was central to participation in virtual communities of practice too. (Eric:29) They are fit into spare time, and participants mention that they design the way they participate in online communities so that the material is convenient to use. When communities are inconvenient to use, they are seen as being of lesser value. (Allen:40). In most cases, participants mentioned that other members of their groups were called on to advise on specific project challenges or issues (Deborah:37), but there was also mention of discussions of larger business, cultural, pedagogical or theoretical issues (Barbara:53)

Physical proximity of people within an organization influences the membership in an informal community of practice, probably because it supports the convenience factor. If people sit near each other, they naturally interact. This informal engagement leads to shared experience and the development of a shared culture.

Physical proximity also draws artificial boundaries around the community, and it excludes some others who work in other areas. This, of course, is no surprise; management literature is rife with advice about where to place employees in workgroups. But it is not necessarily considered by managers of instructional design. It may be that adjusting the physical seating of individuals in ID workgroups may be one of the single most important contributions to promoting the development of a community of practice. How does this translate to online communities? Virtual proximity may include how immediate or apparent the community is in the routine workspace of the user. For example, a list that pushes email to the user, or a chat space that is always available and alerts the participant when someone logs on may create a proximal virtual environment for the participant.

Trajectories of Participation

Trajectory of participation is a phrase coined by Wenger (1998) to describe the direction that people in communities of practice are moving. Are they orbiting the periphery of a community? Do they occupy a medial or peripheral position?

The amount of time one is in a community of practice mediates the position in the community. A new person in a community is naturally on the periphery, given that the designer is struggling to learn the cultural conventions that are second nature to more experienced members of the community. This is evident, even when a very experienced designer joins a new community of practice. This suggests that communities of practice are localized and contextual; one can't transport experiences from one community of practice to another, especially when the embedded cultural values of the communities differ substantially.

There is a sense that it is necessary to get experience with a particular community of practice in order to be accepted into its inner circles. At least, that is the perception of some participants—that they are isolated when they are new to a community, but they will move to a more central position once they gain experience with the community. (Eric:59) .

Sometimes, an individual’s position in a community is defined by the formal role or position held in an organization. Dynamic communities of practice don't automatically accept them as leaders or participants, but ultimately, they require social acceptance in order to perform effectively in the community of practice (Eric:60).

Features of ID Communities

History: Communities are supposedly stronger when they share history and culture. Conversely they are weak when they are based on general interests and abstract ideas. If this is the case, then the communities of practice within instructional design would seem to be characteristically weakened by their lack of a sense of shared history. There were no explicit comments about the shared history of instructional designers within a particular community of practice, with the exception of a comment about how the military roots of systems models of instructional design contribute to suspicions by people outside our communities.

But this doesn't mean that the communities don't share a history; it is just that the participants don't think to talk about it as a prominent feature of their communities. The fact that most communities of practice identified by participants were in-house communities may mean that the shared history is so rich or intimate that it is taken for granted.

Participation: Participation, even passive participation as a spectator, was seen as a key element of community. It can be interpreted as the frequency of contact with other members of the community. This feature was common to face to face and virtual communities. In virtual environments, evidence of participation included the number of messages, their length and whether conversations continued. This is consistent with the notions of engagement and alignment described by Schwier (2001). Members of communities of practice go beyond interaction and engage each other in meaningful conversations. This engagement, over time, leads participants to align themselves with the community and its central values and messages.

Mutuality: Participants mentioned that mutuality is an important feature of participating fully in a community of practice. Communities spring from, and are maintained by interdependence and reciprocity. Participants typically construct purposes, intentions and the protocol for interaction. But mutuality appears to be something that is "grown into" by participants. One spoke to the notion of growing into a position where it was possible to make contributions that were as valuable as the ones received by the community.

Another participant mentioned that experience with the group was just as important as having a fresh perspective or unique knowledge to share. New members of communities may have ideas that are useful, but they expressed concern that established communities may be reluctant to welcome them (Barbara:24).

Plurality: Communities draw much of their vitality from "intermediate associations" such as expert/authoritative contacts, and other groups in areas peripherally related to instructional design. Participants spoke frequently and passionately about the associations they had with groups outside their organizations and immediate instructional design roles, and how those groups informed their ID work.

But plurality is also a feature within some organizations. It was clear that some organizational cultures encouraged, and even mandated, that various departments within the organization that had influence on the learner's experience, broadly defined, were brought into the instructional designers' teams, and by extension, their communities of practice.

Plurality appears to have importance, not just for the particular learning challenges being faced, but also for the institutional culture. When plurality has strong influence in an instructional design community of practice, it means that instructional designers will be bringing a wide range of considerations and solutions to bear on learning problems. When complex learning systems are designed in a culture that encourages plurality, there is a higher likelihood that all important variables will be considered.

Tacit knowledge: As reviewed earlier, knowledge management literature pays particular attention to tacit knowledge and its role in communities of practice. Tacit knowledge is what an experienced practitioner knows internally, but that isn't part of the explicit knowledge held by the community or organization. In a profession as complicated and distributed as instructional design, moving hidden tacit knowledge to public, explicit knowledge is important to the growth of the profession, and is one of the unstated goals of many communities of practice.

Participants were asked about tacit knowledge they held—ideas, procedures, strategies or tactics they had invented or learned, but that weren't common knowledge in instructional deign. Interestingly, they had little to offer at first. It was possible that they were humble or the question was intimidating, but at any rate, participants had little to say immediately.

But elsewhere in the interviews, the designers offered dozens of examples of unique or creative solutions and observations about instructional design. Examples of their tacit knowledge included such things as how to deal with difficult clients, job aids for applying criteria to projects, or how to gather expert advice to address difficult design problems. It just wasn't thought of as tacit knowledge. Instructional designers are problem solvers, and they invent solutions as a routine matter in their daily work lives. But they don't necessarily see that this type of knowledge as significant or substantial, nor do they think of ways to move it into the public arena.

At the same time, it was clear that members of in-house communities of practice constantly probed for and shared solutions to design problems they faced in projects. It appears that the process of transforming tacit knowledge into explicit, shared knowledge is an informal, serendipitous occurrence in the organizations we've included so far. These are healthy organizations that promote interaction among designers, and this naturally leads them to share new ideas. But one could speculate that in unhealthy or highly competitive organizations, such knowledge would not be shared as easily or informally. Tacit knowledge could be seen as strategically important, or offering a competitive advantage.

Repositories of knowledge: We think of communities of practice as groups of people. This is most certainly what most instructional designers mentioned when asked about their own communities. However, one person considered online resources to be an important, if unidirectional, part of the community of practice. Can shared resources and forum archives act as communities of practice? They don't fit formal definitions easily, but they certainly can be thought of as repositories of thought from communities of practice. There is really very little difference in searching a repository of information and lurking in a chat session. If one is primarily an observer, that action can still satisfy the requirement of participation in the community.

Virtual Communities of Practice

It was clear that participants relied heavily on online repositories of information, and to a lesser degree, participants mentioned that they participated in active online communities of practice. These included listservs and email lists for the most part—asynchronous communication environments. Comments from the participants suggested that they viewed virtual communication and interpersonal communication as functionally equivalent (Allen:31).

The people interviewed are experienced users of technology, and they view virtual technologies as another mode of expression, with concomitant strengths and weaknesses. One can speculate that instructional designers, as a group, are probably more experienced and sophisticated with using online communication technologies than most other professional groups. Given that many instructional designers are creating online learning resources, it isn't surprising that they see virtual communication as a natural extension of their face-to-face communities of practice.

Not that there aren't limitations; indeed, one participant struggled with the uncertainty that accompanies electronic communication. Uncertainty and ambiguity plague virtual communities of practice. For example, if someone asks a question or makes a comment in a virtual community of practice, and there is a limited response from other members of the community, the silence can be interpreted by the sender in a number of ways.

Similarly, it is misleading to speak in gross terms of the characteristics of "online communities." They differ from each other as much as they differ from other kinds of communities. They differ in tone, intensity, usefulness, number of subscribers and content among other things. In these interviews, participants described general networks, professional resource repositories and forums, intranet discussion groups in organizations, student societies and email exchange groups. It is important to keep in mind that when we discuss online communities, we are really talking about a wide array of entities that operate on several levels and within a bewildering number of contexts.

Purpose: Virtual communities of practice, just like other communities of practice, don't just happen; they form when individuals share a purpose that has importance either personally or professionally. The clearer and more important the purpose, the stronger the adhesion of individuals to the group. In education, and perhaps in virtual communities of practice, we sometimes make the mistake of thinking that individuals will be drawn to a community merely because it is there and people have interests in common. Of greater importance seems to be the issue of whether the community will contribute something tangible to the participants. This "social capital" may be common to the members of the group, but it is more likely that a strong community will speak to the individual needs of participants, needs that hover around a central purpose, but that take on a variety of meanings for individuals. At any rate, it is vitally important that communities of practice can answer the question, "What will I get out of it?" to be successful (Allen:64).

Managing online communities: Online communities can be managed differently than most face to face communities, mainly because of the control and anonymity provided by technology. For example, one can filter messages from an online community and look at them when there is time, or one can route messages to a dedicated mailbox. Some online lists permit participants to receive a digest (single message) that contains all of the messages on the list that day. That can be very useful for managing time, but presumably reduces the immediacy and spontaneity of the interactions with the groups. At any rate, designers reported managing their interactions online in skilled and deliberate ways (Allen:38).

Trinity--people, context, content: The context of a virtual community of practice and the people involved in the community are most important to its success according to one participant. But this position was qualified by others, who identified content as the central feature that drew them to communities. The impression this left was that for virtual communities, all three things are vital. Content is of course important—it provides the substance around which discussions form. But in virtual communities, it appears that participants are looking for more. They are looking for a context that is convenient to use, and they are looking to expand the number of qualified people they can engage, or access to leaders in the field who are otherwise inaccessible. This trinity forms much of the social capital of virtual communities, the glue that holds them together (Allen:66).

Receiving a great deal of advice is typically desirable, and when several people give similar advice, one interprets the advice as more reliable. By definition, it is, but caution was expressed about the seeming reliability of converging advice in a virtual environment. Contrary advisors may be silent. In fact, silence may cloak several different interpretations of the item under discussion (Allen: 57). Therefore, it is reasonable to think of converging ideas as less representative of the population from which they are drawn.

Anonymity and social distance: An interesting issue is the role of social distance in building credibility. A common joke is that an expert is someone from more than 25 miles away with PowerPoint. There are old saws like "absence makes the heart grow fonder" and "familiarity breeds contempt." The participants made some interesting comments that suggested something similar happens within a virtual communication system. Is the development of a strong community of practice necessarily dependent on participants becoming more intimate and reducing the amount of social distance? Maybe there are advantages to promoting a certain amount of distance. Perhaps social distance contributes to the attraction of some members to a community of practice, and thereby strengthens the glue of the community (increases the collective social capital of the group). One individual mentioned very clearly that anonymity is an important part how he participates in virtual communities (Allen: 69). It is important to this person that he is able to dip into and out of a community, use it for what he needs, and then leave. In professional communities of practice, he isn't looking for personal or intimate associations.

At first glance this seems counter-intuitive; we think of communities as places where people make personal investments. But that isn't necessarily the case for professional communities of practice. In these settings, the agendas may be more utilitarian, at least for some participants. In all cases, it is clear that personal agendas will shape the nature of communication in a virtual community of practice in much the same way as personal agendas influence temporal communities.

Social Change and Agency

There was a clear message that there was a need for the types of social change that ID can provide, and evidence of the influence of ID generally on institutional policies and issues. There were also a number of frustrations and worries that were articulated about the lack of influence instructional designers felt in their organizations.

There are some really huge issues that are moving forward in distance education, especially technology- enhanced learning issues. If the institutions-the academies-do not look at these issues very seriously, very soon, they're going to find themselves in policy nether land, where nothing works. (Barbara:62)

Barbara's comment warns of a problem identified by Kowch (2003), where the traditional policy-making structure in most institutions of higher education are not positioned to address emerging pan-institutional issues effectively; that addressing pressing, multi-dimensional socio-political issues requires changes that fundamentally challenge the policy-making structures of institutions. In this section of the paper we will consider the kinds of social change that instructional designers identified, the kinds of contributions they make to them, and some of the unresolved issues that organizations face.

Social Change: Types and Examples

Instructional designers described different types of social change that they influenced, and for convenience we group them into institutional issues and professional issues. By institutional issues, we mean those things that engage the organizations or structures of society; by professional issues we mean those things that engage individuals and groups, independent of their organizations.

Institutional issues: Designers mentioned projects that had wide influence, such as changing social attitudes about stereotyped groups (Deborah:54). They also mentioned institutional growth in the prominence of instructional design positions (Allen:75), different levels of responsibility to clients, learners and humanity (Deborah:53), and a growing appreciation for instructional design by management (Eric:46).

Professional issues: Participants stated that they had seen evidence of transformed practice among educators as a result of their involvement in instructional design, particularly on technology-enhanced learning projects. These were often characterized as a shift from content-centered design to learner-centered design (Barbara:79). But changes were noted in how instructional designers encouraged organizing and structuring learning by modeling good practice (Deborah:58) and focusing attention on important learning outcomes (Eric:33).

A consistent message was that as instructional designers, people felt they were able to influence larger groups of people than they could in other educational roles (Deborah:20). But there was a measure of caution, expressed as a concern that in order to have a sustained influence over an extended period, one would need to be working on content areas that they felt were important. Perhaps, this suggests that the supposed content-free nature of ID doesn't permit designers to connect to substance they value. Is the personal value of what we contribute significantly bound with the content areas in which we design? Do designers hunger to work on content they value?

One of the most provocative statements spoke to the irregularity of personal impact. It is likely that instructional designers feel as though their contributions are uneven. They make an important difference sometimes, but not necessarily often enough to feel a high degree of personal satisfaction (Allen:72). When we consider the effect of ID on social change, and look for large influences, we may overlook the fact that small contributions may have a large effect in the long run (Deborah:53)

This may be especially true of ethical stances and higher values, and how holding to them can have profound effects. Perhaps humility about our influence is reasonable and sufficient, even admirable. Instructional design may not be so important on a grand scale, but the contributions made can have wide and profound influence in the long run. For example, if we insist on gender-neutral language, we may in the long run, contribute to a new understanding of equality.

Designers know that they have a great deal to contribute, and that they make a big difference in the quality of instruction they influence. But they work in a shadow profession, one that is not fully understood or appreciated by those in management. In order to be effective in promoting social change, instructional design needs to clarify the kinds of contributions it can make, and make other educators aware of those contributions. It isn't enough to work quietly and effectively in the shadows, and hope that the profession is understood and appreciated.

Issues Not Mentioned

Schwier (2001) posited that learning communities had a future orientation, an idea complemented by Wenger's trajectories of participation in communities of practice (Wenger, 1998). In the interviews with instructional designers to date, little or no discussion of the future direction of the profession or its communities of practice emerged. There is immediacy, a descriptive rather than interpretive tone to discussions about the practice of

ID. Where is it going? What is its direction? Where is it leading? These are items about which the discussants were less vocal.

The interesting question, though, is why were participants reticent on this issue? It is entirely possible that the questions and directions of the interviews did not encourage this kind of observation. Maybe the participants were thinking so carefully about describing the nature of their work that they didn't consider whether the communities of practice had a future orientation. On the other hand, it is possible that this is characteristic of instructional design. Designers work so closely and intensely in the immediate, that they fail to consider the direction they are following to the future.

When asked directly about the significance of instructional design, individuals spoke about their influence on immediate projects, or reflected on specific projects they influenced in important ways. Nobody spoke of how instructional design might be influencing the future of education or training, at least, not specifically.
Is this a story of power and influence in the educational hierarchy? Was Heinich (1998) right when he charged that in our profession we have aligned ourselves with labor when we should have aligned ourselves with management? More importantly, how is a profession sustained? What role does a sense of larger purpose play in nourishing a profession and its participants? Although there are certainly exceptions, Medical doctors view themselves as healers, lawyers see themselves as protectors of justice, teachers see themselves as improving the future through children. What is the simple vision of instructional designers? What is their larger purpose? What is their grand agenda?

Summary

This study unveiled a number of intriguing issues and challenges about instructional designers and their communities of practice, and how instructional designers perceive their participation in sweeping changes underway in education. We see a profession that knows itself, but is struggling for identity and acceptance in the larger educational community. We find that instructional designers invent and participate in communities of practice in ways that challenge our understanding of models of communities. We learned that there isn't a single or global community of ID practice, but rather, hundreds of small, local, effervescent and convenient communities of practice. We see instructional designers struggling to identify their own tacit knowledge, and without systematic avenues for sharing their tacit knowledge with other designers. We find that instructional designers recognize that they have a role to play in the changes currently underway in education, but less understanding of how to express that role forcefully and demonstrate leadership. We see that the focus of designers is institutional more than societal, but that they exhibit high standards of performance and care for the appropriate integration of technology into learning environments.

We emphasize that this is a preliminary study. We are encouraged by the high degree of professionalism, and the thoughtful reflection designers shared with us. If the participants in this study are representative, instructional design is a profession populated by highly competent, intelligent and dedicated individuals who are looking for a way to influence important changes in education and society.

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Scaffolding Higher Order Thinking: Theoretical, Practical, and Experiential Perspectives of Related Techniques and Technologies

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Abstract

The presentations within this session originated from a graduate course that explored research and theory related to techniques for scaffolding higher order thinking. The first paper describes the course participants' experiential accounts of using webpublishing technology for supporting their reflection. The other papers present research-based reviews on teaching and learning of higher order thinking in technology-enhanced environments, including: challenges of changing instructor roles, specific techniques for scaffolding student performance, and challenges and options for assessment.

Paper 1: Supporting Reflection Within and Beyond the Higher Education Classroom (Priya Sharma)

The purpose of this study was to explore and describe participants' experiences of various reflective activities and tools within the context of a graduate course. Participants were interviewed and participant data were scrutinized to identify initial thoughts and experiences with the activities within the course.

Background

The context of this study was a research seminar for graduate (doctoral and masters) students. Within the course, students were asked to develop a research framework or a literature review paper within their specific area of interest. Developing such a product is characterized by the need for students to engage in prolonged sense-making within an unstructured and extensive domain of literature. To delineate the scope of information, students needed to identify, gather, and organize resources. Simultaneously students would need to examine the resources to identify utility and applicability to their areas of research. The identified tasks call for high levels of reflection and self-organization, which sometimes needs to be more overtly triggered and supported. Brockbank and McGill (1998) suggest that encouraging reflective and critical thinking in higher education requires sustained effort from all participants—including the facilitator. In many cases, this means a significant structural and pedagogical reorientation of the learning environment. The traditional classroom setting can support significant reflective dialogue but in many cases, the dialogue stops at or tends to progress very slowly beyond certain spatial and temporal boundaries. To support this extra level of dialogue and reflection outside the classroom, a type of technology known as personal webpublishing was implemented. Webpublishing systems allow individuals to chronologically record and archive postings on the Web. Many Webpublishing systems are available for use and they are mostly characterized by their ability to allow an individual to edit and post from any networked computer with access to a browser and the Internet, thus radically simplifying web authoring. We used a specific type of Webpublishing system known as a Weblog. Individual Weblog posts can be of various lengths and they provide a mechanism for timely logging of thoughts and resources, thereby allowing an individual to build a repository of information.

Procedures and Setting

The course was structured around face-to-face meetings that were scheduled every week for the first two months of the semester. The face-to-face meetings were wholly discussion based and no lectures or presentations took place. Participants engaged in discussion that was initially based on a set of common reading materials but which later became more individualized. In addition, each person in the group posted reflections, resources, and other types of information on their individual Webpublishing spaces.

The group collaboratively established a consensus on schedules and a set number of postings per person. An initial set of categories was also used to guide the logging process. Thus, content could be categorized as a resource, a commentary, a question, a reflection, an action, or as miscellaneous. Interviews were conducted at the end of the semester and interviews averaged about an hour in length. Interview questions focused on exploring participants' perceptions of using the Weblogs and its value in supporting their reflections. Tentative initial findings, from an evaluation and implementation perspective, are presented in the next section.

Need for security

Because weblogs are public and can be viewed by anyone with access to the Internet, there was an initial focus on refining the posts to avoid grammatical and structural errors. Participants admitted that it was an effort to overcome the natural inclination to refine and rewrite their posts so that it was suitable for public viewing. Two participants admitted that they were "afraid" to expose their thoughts and be considered as "stupid" by external readers. Since participants remained uncomfortable with the idea of posting their thoughts in public the logs were made private. Soon after the weblogs were made private, the number of postings increased significantly for at least one participant who had expressed initial discomfort.

Importance of face-to-face support

Although students professed to high levels of interest in using the Weblog system, the face-to-face interactions were important to bolster student motivation to use the Weblogs and also to maintain a more personal interaction and discussion element. Often, class interactions became fodder for further writing on the Weblogs and conversely, the Weblog content became a topic for discussion within class. This combination of two types of expression (verbal and written) in thinking and discussion was admittedly appreciated by the students. In addition, the in-class sessions seemed to function as a mechanism for clarifying and extending feelings about Weblog usage—for example, during the first few weeks of the course, significant time was spent talking about the time and effort involved in using the Weblog and participants perceived that those discussions contributed significantly to their ability to understand the purpose of the Weblogs and also to sustain reflection.

Problems of sustained interaction

The Weblogs displayed a considerable disparity in number and depth of posts made by each person. Some participants spent significant amounts of time to produce very in-depth and reflective postings and they also consistently posted a larger number of posts. Other participants did not post as often or in as much detail. Supporting consistent logging emerged as one of the biggest issues from this pilot. Participants identified two major barriers to using the Weblog—time and established modes of reflection. The perceived paucity of time emerged as a significant factor in diminishing Weblog activity—one of the reasons, was the natural progression of an academic semester. Participants admitted that as mid-semester approached and exams and other assignments became pressing, they found it difficult to sustain posting. Even when other assignments were not at the forefront, the amount of time it took to read and then document thoughts on the Weblog seemed to be a significant problem. This problem was intensified because many of the participants had already established other means of reflection, such as personal diaries and or reference databases and the Weblog posting became an additional and unhelpful step for reflection. One participant, realizing this early on, stopped posting quite early in the semester, while others persevered.

Progression in type of logging

Some participants indicated that they noticed a significant progression in their logging, where logs moved from being more resource-based to include more comments and reflections. Initially, many of the logs contained lists of resources in terms of bibliographies, excerpts from articles, citations to web links, etc., As time progressed, the proportion of the logs changed from just listing resources to commenting on the quality and applicability of the resources to individual projects. In addition, there tended to be a higher proportion of reflective postings and participants felt that they were revealing their positions on a topic more openly and with less fear of being "hurt."

Lack of interaction

Participants cited the lack of interaction between individual logs as one of the most disappointing occurrences within the course. Although the face-to-face sessions were marked by intensive discussion, debate, and interaction, there was no similar occurrence on the Weblogs. Although one participant felt that the interaction was sufficient, the other four participants felt that more interaction would have added significant value to their own thinking and to their final product.

Tentative suggestions for next steps

Based on the Weblogs postings, participant interviews, and in-class observations and conversations, from a design perspective, there are some indications that Weblogs can support reflective thinking and self organized learning. The initial analysis indicates the definite existence of questions regarding micro-levels of intervention—specifically, how to guide the use and practice of personal Webpublishing systems, how to sustain consistent externalization of thoughts on the Weblogs and how to combine these reflections with existing modes and personal practices established by individuals, and also how to encourage and sustain interaction between participants on the Weblogs. These emerged as the most significant issues cited by participants as having influenced their use of the Weblogs.

Paper 2: Strategies to Promote Reflective Thinking in Problem Based Learning (Husra Gursoy)

The continuous changes in the society create considerably complex problems in various fields and therefore it has been recommended that graduates of higher education improve their "thinking skills" that will help them to cope with these complex situations. The capacity to engage in reflective thinking is one of those skills which need to be improved in higher education settings. Although there are various ways in which reflective thinking can be promoted, problem based learning is one approach that provides learners with an appropriate setting that can increase their reflecting thinking while exploring authentic and ill structured problems (Albanese & Mitchell, 1993; Hmelo & Ferrari, 1997). However, without appropriate scaffolding tools, students have difficulty engaging in high level reflective thinking (Hmelo & Lin, 2000). It is important to select appropriate tools to help learners motivating in reflection. This paper will summarize best strategies to support reflective thinking in problem based learning environments. Various scaffolding strategies and their effectiveness in PBL environments will be discussed and suggestions will be provided for future implications.

Reflective thinking

The reflective thinking movement began with the studies of Dewey. He defined reflective thinking as "an active process" rather than passive, means that one thinks things through oneself by asking questions, finding relevant information and eventually by taking responsibility of one's own intellectual development, instead of merely learning from others. Dewey (1933) also delineated reflective thinking from simple "thinking" (such as daydreaming, inventions and beliefs) by indicating that it is goal oriented and aims at a conclusion. Schön (1987) defined reflection as thinking activity for an extended time about a set of recent experiences by looking for commonalties, differences, and interrelations. Similarly, Hatton & Smith (1995) identified some essential issues concerning reflection. They expressed that, during reflection, an individual should learn to frame complex or ambiguous problems, try out various interpretations, and then modify his actions consequently. Reflective thinking provides learners an opportunity to control their learning by assessing what they know, what they need to know, and how they bridge that gap during learning situations. Reflective activities also encourage students to analyze their performance, conceptualize the actions they used in similar situations, and compare and contrast these actions to those of novices and experts (Collins, 1990).

Problem Based Learning

In general, PBL offers a unique environment to learners to promote their reflective thinking. During PBL session, learners generally confront ill-structured problems and attempt to find meaningful solutions. When learners are faced with complex problem solving situation, reflective thinking helps them to become more aware of their learning progress, choose appropriate strategies to explore a problem, and identify the ways to build the knowledge they need to solve the problem. In order for instructors to facilitate the process in different stages of problem solving, scaffolding strategies should be integrated into the learning environment in order to assist students develop their ability to reflect on their own learning. From the instructor's point of view, promoting reflection should result in having learners think more deeply about a topic, thus develop a more complex and interrelated mental schema.

In problem based learning environment, learners confront with different stages. Barrows (1994) defined four different stages of problem solving process. First, the problem is introduced and presented, and then students discuss the problem, generate hypotheses based on their own experiences and past knowledge, identify relevant facts and learning issues. Second, students engage in self-directed learning and search the relevant resources through libraries. Third, students begin to evaluate the sources they have identified – what was useful and what wasn't– and then begin to work on the problem with a better-conceptualized idea. Last, students assess their work by self and peer evaluations at the end of the process.

In order to better present strategies and scaffolding tools to promote reflective thinking in PBL, we will reconstruct these stages with a different perspective. While Barrows stages are iterative and one depends to another, the stages defined in this paper will categorize problem based learning activities at group and individual level, by specifically focusing on reflection. That is, we will examine how and which forms of reflection occur in group and individual problem solving process. We will evaluate the role of reflection separately in each of these three situations. These stages can be defined as follows: (1) Reflection on Group Problem Solving, (2) Reflection on Individual Problem Solving, and (3) Post Problem Reflection.

Reflection on group problem solving

People construct meaningful and sound definitions of social situations and validate their conclusions by comparing themselves to others (Fazio, 1979). Groups seek and process relevant information both cognitively and socially (Forsyth, 1999). In PBL, groups not only use one another as informational resources but also work towards a set of shared objectives. Students in tutorial group collect and share the resources, set goals, and solve the problems together. Each member should be aware of the group process, how the group behaves and acts toward the solution of the problem. A critical aspect of problem solving in ill-structured situations is that people hold multiple, and sometimes conflicting, perspectives of the nature of the problem, procedures for solving it, and appropriate solutions (Kitchener, 1983). For this reason, problem solving methods of instruction in ill structured situations typically use learning groups. These groups provide a means for students to share and examine others' interpretations and perspectives as they work through the problem (Will, 1997). Two strategies that can help for group-problem solving are reflective journals and group reflection and discussion.

Reflective journal is defined as a documentation where each individual write about their learning process in particular situation or an event and make a personal sense of these experiences. One way to follow up group problem solving process in PBL is to have each group member submit a confidential reflective journal to the facilitator that describes (1) what the individual's contributions to the project and the group processes were (2) what each other group member's contributions were (3) how the group process are going (Nelson, 1999). This interaction might take place during the learning activity via dialogues or it may occur later in either formal or informal discussions. Reflective dialogue and discussion during PBL session occur between both group members and facilitator. By sharing ideas, groups and individuals would have clearer understanding of the problem with new ideas and insights to consider.

Reflection on individual problem solving

Each individual processes problems differently. Therefore cognitive process of problem solving is difficult to understand or further define. Even though group members and instructor make important contributions towards the solutions of the problem, each group member needs to construct his/her own understanding of the problem as well. According to Jonassen (1997), problem solving has two important characteristics. First, learners construct mental representation of the problems, which is known as a problem space. Second, problem solving requires active manipulation of the problem space by building models, generating hypothesis, testing solutions and gathering information. Problem solving also requires knowing what to and how to monitor one's performance. (Lester, 1994). A major significance in solving problems occurs when students step back and reflect on how they actually solved the problem and how the particular set of strategies might be improved. Creating suitable representations of the learning process in a rich context is a key point to promote reflection of the metacognitive processes. This could help students to increase: (1) awareness of the learning process; (2) their metacognitive skills; and (3) their capacity to transferring skills to new learning situations (Lohman, 2000). Through metacognitive skills, the learner forms a mental representation of the problem, selects plans and strategies for reaching the solution and identifies the obstacles that slow down progress (Davidson and Sternberg, 1995). In order to practice problem solving process at individual level, several reflective activities are suggested including concept mapping, using reflective diaries, modeling, and prompting.

Post problem reflection

Post problem reflection is necessary to both review the knowledge gained through the problem and make the reasoning explicit through the problem. Post problem reflection occurs when the problem is understood and solved at both group and individual level. Each group member reflects on their learning experience at individual level, and group's member's contributions at group level. Here, post problem reflection is categorized as self evaluation and peer evaluation. An important element of the problem-based learning is to help students identify gaps in their own knowledge. “When the problem is finally solved, learners can learn much by reflecting back on what was learned about both the problem domain and the problem solving process (p.67)” (Reigeluth, 1999a). The following guidance would be helpful for students to structure their reflection: 1) Have them compare the problem solving process to their past learning experiences. 2) Have them identify the obstacles or difficulties they encountered in the problem solving process. 3) Develop criteria to assess the students’ performance on the task and their problem solving skills. Have students reflect their own learning based on these criteria. 4) Have them reflect their group learning process. Peer evaluations are considered as a significant part of the evaluation process. After the problem solving process finished, instructor should request a confidential reflection from each group member to be able to identify problems that the group encountered and provide individual feedback during the process. These individual reports give chance students to reflect on the problem and the process in which they were engaged.

Conclusion

This paper focused on strategies to develop and promote reflective thinking skills, particularly in problem based learning environments. Several strategies to enhance reflective thinking have been suggested based on common sense in literature. These activities have been categorized into two phases as individual and group problem solving process. Reflective activities on both group and individual problem solving have been summarized and examples of related literature have been provided. At the end, reflective activities for the post problem reflection have been introduced, at both individual and group level.

Paper 3: Designing a Classroom as a Technology-Enhanced Learning Environment that Prompts Student’s Reflective Thinking in K-12 (KyoungNa Kim)

The explosive growth and development of technology requires new knowledge and learning skills (Lin, Hmelo, Kinzer, & Secules, 1999). Educational researchers have been publishing voluminous amount of new works associated with learning theories and extensive educational issues regarding technology integration into learning environments. Parallel with these trends is the role of instructional designers working with design and development of instructional technology. Their goals are to design and develop educational technology systematically and to integrate existing technology to produce more effective learning. One of the examples that are associated with this view is revealed in a higher-order educational goal. For example, "Students need to learn...to be able to state why a question or argument is significant and for whom; what the difference is between developing and justifying a position and merely asserting one; and how to develop and provide warrants for their own interpretations and judgments (Association of American Colleges, 1991, p.14).”

In other words, many educators and instructional designers currently espouse the view that a major goal of formal education should be to help develop the student’s ability to think reflectively in order to decide which sources are useful and reliable to make sense of information. These skills are viewed as vital, not only to help students solve problems, but also help to educate them to become life-long learners who are able to flexibly adapt learning to new situations (e.g., Bruner, 1993). Therefore, it is implied that a new paradigm shift is to be expected in designing a learning environment for K-12 that includes technology and teachers to support learners’ reflective thinking. I support the idea that “it is the classroom that the opportunity to foster thought either arises or may be created” (Hullfish & Smith, 1961) and that formal education takes place in school. As a result, I believe it is proper to turn to the classroom environment as one of the primary learning environments when we consider the question for fostering reflective thinking/ activity on the part of students. There are research findings that technology can provide scaffolding for reflection and that without appropriate support students have difficulty engaging in high-level reflective thinking (Lin, et al., 1999). It is important to look at the design issues and elements that should be considered in supportive learning environment design, which includes the design of different technologies and strategies.

Reflective Thinking and Its Scaffolding: An Essential Ingredient in Learning

It has generally been assumed that learning how to think opens the door wide to enhancing future student learning (Hullfish & Smith, 1969). Especially, the explosive growth of technology that includes World Wide Web requiring students to learn not only how to use resources to find relevant information but also how to make sense of information makes thinking especially important and decide which sources are useful and reliable (Lin et al, 1999).

Therefore, in this new learning paradigm something other than “just thinking” is involved. In other words, it requires learners to be able to think reflectively and critically to manage this learning process.

Many educational psychologists and philosophers have proposed various terms and definitions associated with higher-level of thinking ability such as “higher-order thinking”, “complex thinking”(Jonassen, 1996), “critical thinking”, and “reflective thinking” (Dewey, 1933; Hullfish &Smith, 1961; King & Kitchener, 1994). These terms are commonly and confusingly used. In this paper, I will use the term “reflective thinking” as defined by Dewey (1933): “Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusion to which it tends.” Therefore, reflective thinking is viewed as a thinking process reflecting specifically to the processes about what has happened. This process leads students to assess what they know, what they need to know and how would be the situations and is to make judgments to construct learner’s own knowledge. In terms of K-12, it was discovered that young students perceived the learning environment as one of the most important factors that prompt and support their reflective thinking (Koszalka, Song, & Grabowski, 2002). However, there has been little research into learning environments associated with K-12 education that support and scaffold learners’ reflective thinking. Therefore, it is invaluable that this study investigates what is taking place associated with this endeavor and finds what should be needed for designing supportive learning environment for students’ reflective thinking.

Technology Scaffolding for Supporting Students’ Reflective Thinking

Technology can play a powerful role in supporting student reflection (Lin, et al. , 1999). From the review of the literature, Lin, Hmelo, Kinzer & Secules classifed four types of technology design features that provide scaffolds for reflective thinking: (1) process displays for displaying problem-solving and thinking process; (2) process prompts for prompting students’ attention to specific aspects of processes while learning is in action, (3) process models for modeling of experts’ usually tacit thinking processes so students can compare and contrast with their own process in action, and (4) reflective social discourse for creating community-based discourse to provide multiple perspectives and feedback that can be used for reflection

The Classroom as Reflective Community

With regards to K-12 learning environments, it is the classroom where learners, teachers, and technology are in one place. When they are incorporated into an optimal learning environment for supporting learners’ reflective thinking, “partnership” among them are required (Lin and Hsi, 2000). Here, in this section, I would discuss designing a “classroom” that provide “optimal learning” for students’ reflective thinking. In terms of the classroom as reflective continuity, as early as in 1960’s, Hullfish and Smith emphasized the classroom environment as a place where the opportunity to foster thought either arises or may be created (Hullfish & Smith, 1961). To illustrate the classroom as reflective continuity, they asserted that when we consider the question of fostering reflective activity on the part of students, it is in the classroom that the opportunity is provided to foster thought. In addition, they stated it is proper that whatever is done in the classroom should occur in relationship to a pervasive reflective atmosphere. Coupled with this earlier statement, there are also recent researchers who addressed “classroom” as on of the important learning environment. For instance, Collins & Bielaczyc (1999) proposed a theory “learning communities in classroom” and it offers some primary methods regarding the culture of the learning environment in classroom. Also, they raised a number of issues about the design of learning environments related teaching and learning culture of classroom. With regards to an optimal learning environment for supporting learners’ reflective thinking, “meaningful learning” is to be taken into account for design consideration. It puts strong emphases on learners’ reflective thinking for it to happen as well as requires learners’ interacting with learning environment (Jonassen, 2000).

Strategies and Scaffolding for Promoting Reflection in the K-12 Classroom

When it comes to fostering reflective thinking in K-12 education, such other potentially important factors as teacher’s scaffolding strategy in class (i.e: question prompt, instructional strategies, and so on), reflective activity (i.e: making observations, asking question, and comparing their understandings with those posed by others, etc.) and collaboration with peers and adults.(i.e: discussion, tutoring, and peer evaluation, etc.) must be considered (Douillard, 2002; Koszalka et al, 2002; Wood, Bruner, and Ross, 1976). Primary elements research indicates are teachers, tasks, reflective thinking tools, and instructional environments (Koszalka et al, 2002). First, the role of the teacher in scaffolding students’ learning is crucial to the development of reflective thinking not only while the students are engaged in the task but also in the creation of a learning environment that encourages young children to actively play and/or explore the objects and ideas that they encounter (Yelland, 1999). Teachers can prompt students’ reflective thinking by asking reflective questions as well as explaining reflective concepts to students

(Moon, 1999; Virtannen et al, 1999). In addition, researches suggest there are some other strategies that can encourage reflective thinking: providing students with opportunity to have discussion(Brookfield, 1986), inquiry-based teaching (Kroll, 1992), and peer tutoring experience (Wood, Bruner, and Ross, 1974), which require student to work together with their peer students and teachers to facilitate students' learning with scaffoldings.

Second, the task and learning activities students are engaged in in class, when students are provided with authentic tasks involving ill-structured learning activities, challenging work and complex problem solving , those tasks encourage reflective thinking during learning (Hopson,Simms, & Knezek, 2001; Stepien & Pyke, 1997). Dewey (1933) and King and Kitchener (1994) propose that individuals engage in reflective thinking when they encounter problems with uncertain answers, when no authority figure has an answer, when they believe no one answer is correct, and when the solution cannot be derived by formal logic. In addition, the use of reflective thinking can be promoted while students are engaged in active learning, inquiry and problem-solving (Yelland, 1999). Sternberg (1985) also addressed that the use of higher order thinking skills and the use of metastrategic processes that requires students' reflective thinking are characteristics of effective problem-solving environments. Third, key types of tools that scaffold students' reflective thinking such as reflective journal writing, guiding questions, and concept maps are important in fostering students' reflective thinking (Kinchin & Hay, 2000; in Koszalka et.al, 2002). There is a shared assumption of educators that reflective writing can promote reflective thinking (King & Kitchener, 1994; Ross, 1990).

To give a picture of what learning environments is taking place in practice that support students' reflective thinking, I describe two exemplary learning approaches that "fits" within the reflective thinking teaching-learning culture and their elements associated with scaffolding and support: Problem-Based Learning (PBL) and Open Learning Environment (OLE). The features that support and scaffold learners' reflective thinking in each approaches and how they include reflective thinking will be explored. PBL is one of "the constructivist pedagogical designs that are based on the assumption that learning is a product of both cognitive and social interactions in problem-centered environments" (Hmelo & Evensen, 2000; Greeno, Collins, & Resnick, 1996; Savery & Duffy, 1994) as well as a new student-centered learning paradigm (e.g., Reigeluth, 1999; Barrows, 1988). According to Koschmann, Kelson, Feltovich, and Barrows(1996).

OLE has placed emphases on "scaffolding" in more specific ways. To illustrate, Open-ended learning environments are comprised of four major components: enabling contexts, resources, tools, and scaffolds (Hannafin, Land, and Oliver, 1999). Enabling contexts serve as a catalyst for constructivist learning. Usually presented as a problem or project, enabling contexts provide learners with a purpose or goal for subsequent activity. As learners pursue learning goals, it is critical that they have access to relevant resources to help them achieve outcomes. Resources, which can take the form to documents, human experts, databases, for example, are intended to support learning. Tools comprise the third component of open-ended learning environments and equip learners with the means to externalize what they know. In an effort to provide learners with support while learning, scaffolds comprise the fourth components of open-ended learning environments. When learners are in pursuit of learning goals, scaffolds help initiate and sustain meaningful learning by assisting learners as they engage in conceptual, metacognitive, procedural and strategic knowledge processes (Hannafin, Land, and Oliver, 1999).

Discrepancies between ideal and practice: Efforts to embrace some practical issues

I have discussed three important factors (technology design features, PBL, and Open- learning environment) that support student's reflective thinking. Just as Lin et al. suggested that they eventually could develop programs that incorporate all four technology design features in a single system, I have hope that those above key features supporting learners' reflective thinking could create an environment where a combination of these features is placed in a single system. However, there has been found discrepancy between our anticipation and the practice. Dewey already made a statement as early as in 1916 in his famous volume Democracy and Education: "no one doubts, theoretically, the importance of fostering in school good habits of thinking. But apart from the fact that the acknowledgement is not so great in practice as in theory, there is not adequate theoretical recognition that all which the school can or need do for pupils, so far as their minds are concerned (that is, leaving out certain specialized muscular abilities), is to develop their ability to think." There is another discrepancy, which is associated with technology integration that is taking place in school. For instance, Jonassen (1995) proposed some suggestions with regards to supporting communities of learners with technology. He, however, acknowledged that he doubted about its practice. He argued that "the most productive and meaningful used of technology cannot occur in traditional educational institutions," and "until we reform our conceptions of learning, technologies will continue to be delivery vehicles and not tools to think with."

Given the fact that formal education goes with the classroom, it can be a ground for designing learning environments that support students' reflective thinking, which includes engagement of teachers, students, and technology's role, even though there are discrepancies between ideal and practice. To create a learning environment that can support learners' reflective thinking in K-12, there should be efforts of a confluence and collaboration of the strength from technology design features embedded in learning environments design, teachers, and peers, where students are supported and scaffolded by those factors that prompts their reflective thinking in an optimal learning environment.In addition, more research is needed to investigate what are the features that prompt students' reflective thinking. Also, further research is needed to examine how both instrumental design principles and technology design features can be incorporated to provide a learning environment that supports and scaffold teachers' instruction as well as students' learning in K-12.

Paper 4: A Review of Literature on Self-Directed Learning in a Problem-Based Course (David R. Morales)

Self-regulation is the learner's ability to monitor relevant aspects of their learning as it relates to obtaining an established goal or standard of performance. Researchers have related self-regulation to a learner's dependency on the instructor for learning (Keller, 2002; Boggiano, Flink, Shields, Seelbach & Barrett, 1993).), as influencing a learner's behaviors (Beston, Fellows & Culver, 2001; Ley & Young, 1998), motivation (Hofer & Yu, 2002), and established goals (Schunk & Ertmer, 1999) to engage in new learning environments (Estee, 1999; Lohman & Finkelstein, 2000). The focus of this report is on reviewing literature related to the theory of self-regulation in problem-based learning courses. Specifically, this report will describe how instructors in higher education support learners in efficiently and effectively self-directing learning.

Problem-based learning evolved from the scientific model for inquiry (Churchman & Ackoff, 1950). Inquiry learning is a process where learners interact with the learning environment to deductively or inductively resolve questions and hypotheses through evidence based on data acquisition. The methods used for data collection, the amount of time and data required to resolve this disequilibria is dependent on the type of questions and hypotheses that are generated, and the goals for accomplishing the outcome. Churchman and Ackoff (1950) describe it as an iterative model based on the "science ideal." The components of this model have the learner constructing a module, describing the problem, designing the experiment, testing their assumptions, and drawing conclusions based on prior knowledge and experience.

The manner in which a quandary is developed and described will drive interactions, data acquisition, self-regulation, and learning outcomes. In addition, the activity drives the learner's selection and rejection of data, and "relevancy and irrelevancy of hypotheses and conceptual structures" (Churchman and Acker, 1950, p. 198). In addition, Prior knowledge influences the perceptions and actions of the learners. Learners continually reflect upon information and experiences to make judgments when engaged in complex processes (Dewey, 1910; Ennis, 1987; Lipman, 1991; Halpern, 1999; Kuhn, 1999).

Research related to self-direction describes a positive influence on learning goals, self-evaluation, and self-regulation on university students enrolled in an introductory course for computer-skill acquisition when goals and objectives are explicit (Schunk & Ertmer, 1999). In addition, perceived over control on a learning task negatively influences a learner's self-regulation strategies (Boggiano et al.,1993). Lohman et al., (2000) studied the influence of group size on self-direction and problem solving in a problem-based learning format. The results showed that medium size groups of four have the greatest impact on self-direction.

In conclusion, the literature reviewed for this report shows that clear and explicit goals, motivation, learning team size, perceived instructor control, and experience with instructional methods and concepts will impact a learner's self-direction in research based activities. In addition, learners may still be dependent on the instructors to direct their learning. If the goal is to have learners develop knowledge and skills that will help them function in careers where information and technology are continually changing then it is essential to have students develop the motivation to initiate, apply, and refine research strategies.

Paper 5: An Instructor's Role Change In Process: Moving Toward a Transformative Model of Instruction (Beth Sockman)

"Instructor as facilitator" has become an accepted role in education (Carr-Chellman & Dyer, 2000; Cheng, 2001; Hargreaves, 2001; *Learning for the 21st Century: A Report and mile guide for 21st century skills,* ; Mok & Cheng, 2001; K. L. Peck, 2003). However, the transition from the traditional role to the new role can be problematic (Billings & Fitzgerald, 2003; Carr-Chellman & Dyer, 2000; Rogers, 1995; Shulman, 1999). This study, chronicles one instructor's exploration of transition from a transmittive model of instruction, which parallels the instructor as presenter paradigm, toward the transformative model of instruction, paralleling the instructor as facilitator role. Using Brockbank and McGill (1998) as a framework for the study, the instructor records her learning through journal writing (Lukinsky, 1990) and peer feedback (Brockbank & McGill, 1998). After each instructional strategy, a retrospective analysis highlights conflicting emotions, trials and inner resistance. The use of I designates the author.

During the first semester, of teaching an introduction to technology course for educators, I personified an instructor's contradiction. I believed that transformation occurred when unexamined beliefs and actions were questioned, and the role of the instructor was to facilitate this process. But, in practice, I had taught the course using a transmitter model, embellished with hands on learning experiences. This contrast led to a dissonance, which I was anxious to alleviate. In an effort to align my theory and practice, three tactics were chosen for the process: 1.) Keeping a written journal (Lukinsky, 1990) 2.) Reading related literature (Glaser & Strauss, 1967; Lukinsky, 1990) and 3.) Participant and observer checks (Creswell, 1998; Lincoln & Guba, 1985; Patton, 2001; S. M. Peck, 1993).

Analysis focused on identifying and explicating the tension I felt moving from the transmittive model toward the transformational model. The term lesson replaces the traditional use of the word theme since each experience taught a lesson to me through which I became cognizant of a new discrepancy. Each lesson is situated within an instructional strategy that aligned with a transformative model of instruction. Embedded within each lesson there is construct entitled, pedagogical discrepancy which highlights the emotions and inner tension in the context of the learning experience. Additional literature was intertwined throughout the themes to help make sense of the dynamic learning (Fullan, 1993; Fullan & Stiegelbauer, 1992) and provide the next step toward growth.

Lesson: It is easier to tell than listen

Context: Students had created rubrics, some rubrics seemed incomplete to me and needed correction. In order to correct students in a timely manor, I wrote comments on the rubrics. I had expected to student to address questions and to revise their rubrics. To my surprise, no one had a question. In one instance I told a group about their mistakes. Upon returning fifteen minutes later, I found that the group had not revised their rubric.

> Pedagogical discrepancy – Transmitter thinking: I told the students directly about their mistakes, and spoke with them in a small group setting. Students should have corrected their mistake. Transformative thinking: The students did not dialogue; the students did not question their assumptions.

As a strategy to help students question their assumptions, Brockbank and McGill (1998, pp.110-104) advocate the use of assessment triangulation by the instructor, student and peers. I was the only one giving feedback to the students. Instead, students could have offered feedback to one another. It took another lesson to make me aware of how deeply "telling" was entrenched in my teaching style.

Lesson: Be humble and learn from the students

Context: I slowly learned to listen. A student led a discussion in an on-line discussion where students would begin get their "inside out" (Shulman, 1999). The discussion leader's first question was: "How is knowledge of material acquired (for learners of any age)? For instance, by classroom lecture, studying bookwork, memorizing facts, applying new concepts, personal experiences, a combination of any of these or different contributors." (Discussion board, Spring 2001)

A response read:

> I think true knowledge is acquired in many ways for different people. …In most cases in high school and even in college, the subjects from whom I garner the most knowledge are those that intrigue me, for the others I often have found myself memorizing. It is hard to intrigue everyone's interest when teaching, but there are certain ways that most students seem to acquire more knowledge. Often memorizing facts, reading the textbook and listening to lectures are the least affective ways to get someone to obtain knowledge. (Student response to discussion board, Spring 2001)

The thoughtful responses surprised me. For the first time, the students spoke about their personal experiences. Yet after reading the students response, I felt threatened.

> *Pedagogical discrepancy: Transmitter thinking: I am looking at the discussion board and am intimidated. The thoughts being generated are highly thoughtful, insightful, and erudite. I think this (my intimidation) comes from the need to "give an answer" or at least have an answer in my head where I am leading the students. …. How can I help them make clear to themselves, their sense of logic – not necessarily bring them to my logic? (Journal entry, Spring 2003)*

Slowly, I began to listen and use guidelines for facilitating discussion (Brockbank & McGill, 1998; Brookfield, 1995; Browne & Freeman, 2000) and giving students more choice.

Lesson: Grading the end product or acknowledging the risk?

My last challenge dealt with assessment while grading a particular student. He had created a web page that was incomplete. Unlike the rest of the class, he had experimented with various features such as using flash buttons and frames. He had gone beyond the work of anyone else in the class, but had not finished the web page.

Pedagogic discrepancy – Transmitter thinking: The student did not finish all of the criteria I had established for the course. A grade means upholding a standard. Transformative thinking: The student already knew how to make web pages and instead took a more courageous route. He completed all other assignments and always questioned. Assessment should reflect the students' risk taking, not only my pre-prescribed standard.

Throughout the semester, I had become acutely aware of my own failures in order to grow. Writers on innovation in the new economy discuss failure as a goal in experimentation in order to exploit creativity, boundaries, skills and eventually create successful innovations (Matson, 1996; Peters, 1997). In science, more time is spent with failed experiments than with successful ones. These beliefs and experiences influenced my grading.

Assessment may be the most important factor influencing what and how students learn (Lundquist, 1999; McMahon, 1999). Lunquist (1999) charges that focusing on results inhibits the learning process. He explains that learning requires experimentation, hypothesis and conjecture. If instructors are results oriented, students tend not to take risks. In fact, there is a disincentive for taking risks because risks are time consuming and may not yield results. Again, I had not completely learned from the first lesson in the course. We should have attempted to triangulate our final assessments. Negotiation of assessment is recommended for moving away from an authoritarian structure for assessment and helps learners engage in critical reflection (Brockbank & McGill, 1998; Lundquist, 1999; McMahon, 1999). Risk taking, self monitored learning through self reflection and peer input are critical as we prepare teachers to take on the challenges in education(Cheng, 2001; King, 1999; *Learning for the 21st Century: A Report and mile guide for 21st century skills*, ; McMahon, 1999; Mok & Cheng, 2001; K. L. Peck, 2003).

Discussion of the Lessons

I sought to explicate a personal struggle of an instructors role change as I moved toward a transformative model of instruction. Learning was a slow evolution making small changes in a chaotic fashion in response to my interpretation of learning and resistance. Some learning took on the spiral nature (Reigeluth, 1999). Multiple failures were necessary to correct and substantiate a need for change. The first two instructional strategies yielded similar lessons: Students needed opportunities to speak about personal experiences and beliefs. It was not until I began using the on-line discussion board that I began to listen and they began to tell about their experiences. Learning about assessment also took on a spiral nature. Although I was cognizant of triangulation for my own reflection, I did not apply triangulation to the student's learning. The on-line discussion board took on a dual nature for the class and me. The students had the time to take a stand and synthesize their personal experiences with topics relevant in education. This was consistent with Hawkes' findings (2001) where teachers used a discussion board to engage in reflective practice more than in than in face to face interaction.

In addition, the discussion board provided a scaffolding tool for me (Palinscar, 1986). After the first two lessons, I was aware that I needed to listen to the students (Brooks & Brooks, 1993), but conflicting issues inhibited this from occurring during class. Since I did not feel compelled to give an immediate response, I was able to look for areas that would encourage critical reflection in the students and could practice questioning techniques in writing. A substantial aspect of the learning process dealt with emotional and psychological issues(Fullan, 1993; Fullan & Stiegelbauer, 1992). As Zaltman and Ducan (Ellsworth), posit some of my personal resistance was due to psychological forces such as feeling threatened by student ideas and becoming discouraged by my own mistakes. In one journal reflection I wrote:

Old habits die-hard and new ones seem to have a long gestation period. … One student asked – why do so many professors rely on lecture/read/write format if we don't learn best that way? Why? Newness threatens our identity- threatens who we think we are. I think being an instructor is as much about personal transformation – getting outside of yourself and thinking how learning occurs- as it t is about teaching others. This is so much harder said then done. (Journal, Spring 2003)

Internal tension arose while reflecting during and after each class. Every time I attempted to implement a strategy, I would feel dissonance. Controversy has been called an exciting pedagogical vehicle (Browne & Freeman, 2000). Although it creates a state of discomfort, it can be a healthy uneasiness (Brockbank & McGill, 1998). Writing in a journal provided a safe place for me to honestly address the dissonance and wrestle with the tension between roles.

By explicating the process, it is clear that I am still moving toward a transformational model of instruction. Perhaps, if I had arrived, it would not be a transformation. As Freire notes (1998), to learn proceeds to teach, and to teach is the "fabric of learning" (p. 31). Therefore, I will continue learning while engaging in reflective practice, but submitting oneself to the process of questioning (Freire, 1998) takes intellectual courage. By intellectual courage, I mean the ability to make the academic-self vulnerable to the emotions, the inward struggle, and a community of learners in an effort to improve pedagogical practice. As instructors in higher education, we have the opportunity to shed the old paradigm and explicate the process. Perhaps if we examine our own practice, we can better empathized and have a deeper understanding of what we are asking others to do when making the role change.

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Creating a "Teaching with Technology" Electronic Portfolio

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Abstract

In order to approach the National Educational Technology Standards (NETS), teachers must be significantly better prepared to use technology effectively in their classrooms. The Tech4u.org *website is designed to provide online professional development incorporating content modules based on NETS and offering the opportunity for teachers to create an original "Teaching with Technology" electronic portfolio. The effectiveness of this professional development is examined in this study, which is best described as a work in progress.*

Introduction

In an effort to establish national standards for teachers using educational technology in the classroom, the International Society for Technology in Education (ISTE) noted significant benefits to the use of technology in the classroom, enabling students to become:

- Capable information technology users
- Information seekers, analyzers, and evaluators
- Problem solvers and decision makers
- Creative and effective users of productivity tools
- Communicators, collaborators, publishers, and producers
- Informed, responsible, and contributing citizens

They further emphasize that "to live, learn, and work successfully in an increasingly complex and information-rich society, students and teachers must be prepared to use technology effectively" (p. 4, 2002). Unfortunately, in the public school setting, large numbers of students complain that their teachers are not IT literate, in that teachers do not use technology to its fullest capabilities in class or in assigning work (Regan, 2002).

The National Educational Technology Standards for Teachers (NETS-T) provide a vision of teachers who empower students with the advantages technology can bring, who are equipped with technology resources and skills, and who can effectively teach the necessary subject matter content while incorporating technology concepts and skills (ISTE, 2002). If teachers are to embody this vision, they must have opportunities for meaningful professional development experiences. The *Tech4u.org* website (http://tech4u.org) is designed to provide online professional development incorporating content modules based on the NETS standards and offering the opportunity for teachers to create an original "Teaching with Technology" electronic portfolio.

In an electronic portfolio, teachers can demonstrate their effectiveness in the skills of technology use, as well as their innovation and experience with impacting student learning in their classroom with technology. Portfolios have been widely accepted as effective student assessment tools since the early 1990s. Later, the "assessment only" role of the portfolio began to evolve into a focus on artifacts as evidence of learning (Wilcox & Tomei, 1999). In *Teacher Portfolios: Literacy Artifacts and Themes*, Rogers & Danielson (1996) emphasize the benefit of deep understanding through reflective and critical thinking that can come over time as a teacher develops a professional portfolio. Teacher portfolios may also be used as an authentic assessment to aid administrators or supervisors in evaluating teachers (Glatthorn, 1996).

Purpose of the Study

The purpose of this study was to determine the effectiveness of the *Tech4u.org* online professional development for teachers. The website contains eight instructional modules: File Management, Effective WWW Search Strategies, Multimedia, Teacher Tools (word processing, spreadsheet, and database), Online Communication, Internet Productivity Tools, Copyright, and Web Development. Each module offers the participant an opportunity to gain awareness of technology applications, explore the applications that interest them most, learn technical and pedagogical skills, apply learned skills either personally or professionally, and share and reflect on their experience with other teachers. The culminating project is to create a "Teaching with Technology" electronic portfolio as evidence of their learning and proficiency. Is the course content effective in terms of an increase in likeliness of a teacher to apply instructional technology tools in the classroom increase as a result of participation in the *Tech4u.org* professional development course?

Methods and Data Sources

Two groups of teachers completed the online professional development experience – 17 in the Spring 2003 semester and 11 in the Summer 2003 semester. Both of the course offerings were conducted completely online, with no face-to-face interaction. Prior to beginning the first course offering, participants completed a pre-survey based on the *Technology in Education Competency* assessment instrument. This nine-item Likert-type survey was adapted from *Preparedness of Graduates*, a national survey on information technology in teacher education conducted by ISTE. Upon completion of the course, the *Technology in Education Competency* assessment instrument was also used as a post-survey, with the addition of seven open-ended questions. Due to the minimal amount of information gathered from the pre- and post-surveys in the first course, the researchers deemed it necessary to expand the instrument prior to the second course to gain a more accurate reflection of the total content learned. Eleven 5-point scale questions were added to the first pre- and post-surveys and administered to students in the second course offering. As a result of the decision to improve the instrument, only pre- and post-survey data from the second course is reported in this study, however, interview data from both courses is taken into consideration. Pre- and post-surveys were completed by eight of the eleven students in the second course offering. The surveys measured how likely the teacher was to use particular instructional technology tools in the classroom using a 5-point scale ranging from 1 (*very unlikely*) to 5 (*very likely*). These surveys can be accessed at http://fp.okstate.edu/stansbe/surveys/IT_pre.htm (pre-survey) and http://fp.okstate.edu/stansbe/surveys/IT_post.htm (post-survey).

Personal interviews with a purposive sample of participants from both courses were also conducted to gain further insight into the effectiveness of this professional development experience. These interview transcripts, along with responses to the open-ended questions on the post-survey, were coded for emerging themes. In addition, each student's completed "Teaching with Technology" electronic portfolio, which was assessed with a rubric, was examined in the document analysis phase.

Description of Professional Development Course

The course employed two platforms for delivery of information and interaction. Course content, including instructional modules and ePortfolio examples were accessed via the *Tech4u.org* website. Student product sharing via posted assignments and reflection via threaded discussion databases was accomplished using the Blackboard learning management system (http://blackboard.okstate.edu).

The *Tech4u.org* curriculum is presented as 8 learning modules -- File Management, Effective WWW Search Strategies, Multimedia, Teacher Tools (word processing, spreadsheet, and database), Online Communication, Internet Productivity Tools, Copyright, and Web Development -- and were built around the model of the Technology Learning Cycle (Diggs, 2001). Thus, each module included the following sections:

A. Awareness

Students viewed sample products in the *Tech4u.org* example ePortfolio and read teacher stories of technology use from the Knowledge Innovation and Technology in Education (KITE) database (http://kite.missouri.edu). In reflecting on this part of the cycle, students generally responded to the questions "What module tools or activities are you aware of? What first caught you eye? What held your attention?"

B. Exploration and Filtration

Students read a short description of the module content they were about to learn to assist in making filtration decisions. Reflection in the Exploration and Filtration portion of the cycle centered around what tools were available to students to undertake the module and what products had been created in the past that fit within the particular module.

C. Learning

Depending upon the module, this portion of the cycle included different types of learning tools including online tutorials housed both locally and at other locations on the Internet, interactive tutorials, and text-and-graphics based content which provided an opportunity for students to learn to use the technology which was the focus of the module. Following the instructional portions, students reflected upon the process answering the following questions: "What technical skills related to the module have you learned? What technical skills would you still like to learn? What pedagogical applications would you like to try?"

D. Personal and Professional Application

Each module required students to create a product using the technology learned in the module. In some cases, these products were curriculum materials that could be used in their own classrooms; in other cases, the products were simply personal applications of the technology which were relevant to students' lives at the time they were taking the course. Each time, students reflected upon their application and the process of creating the product.

E. Sharing and Reflection

The final process in the cycle is for students to reflect upon their learning experience of the module as a whole and to share with other class members the product they created in the application step.

The culminating project in the course required participating teachers to create an electronic portfolio including at least one self-selected artifact from each of the modules. Additionally, written reflections on each of the artifacts were required.

Both the first offering (Spring 2003) and the second offering (Summer 2003) of the course were taught by the same instructor using the same materials, syllabus, schedule, and activities. At the outset, each of the two groups of students tended to participate in very much the same way. They would undertake the required readings or content interaction, and post their reflections to the database. The instructor experienced frustration in the lack of student-to-student interaction at the outset at both of the courses. Using both asynchronous (discussion board and e-mail) and synchronous (instant messaging and telephone) instructor-to-student communication tools, the instructor attempted to directly task students with the responsibility and value of student-to-student interaction. This encouragement resulted in an increase in student-to-student communication and collaboration as well as a sense of connectedness to the instructor.

Findings

The research question explored in this study was to determine the effectiveness of the course content based on based on whether a teacher is more likely to apply instructional technology tools in the classroom as a result of participation in the *Tech4u.org* professional development course. The self-reported likeliness to use instructional technology was expected to increase from the pre- to the post-survey, indicating effectiveness of the course. Results of the course mean per question and standard deviation is shown in Table 1.

Table 1: *Course Means and Standard Deviation per Question*

Question Topic	**Course Mean, Pre-Survey**	**Course Mean, Post-Survey**	**Standard Deviation**
Digital file organization	3.375	4.625	-1.25
Digital file organization with students	2.5	3.5	-1
Word processing	4.375	4.875	-0.5
Word processing with students	3.75	4.375	-0.625
Spreadsheet/database	3.875	4	-0.125
Spreadsheet/database with students	3	3.375	-0.375
WWW search strategies	4.375	4.875	-0.5
WWW search strategies with students	3.25	4.5	-1.25
Multimedia presentation	3.625	4.625	-1
Multimedia presentation with students	3.375	4	-0.625
Internet tools	4	4.75	-0.75
Internet tools with students	3.25	4.14	-0.899
Online communication	4.5	4.75	-0.25
Online communication with students	3.625	3.125	-0.5
Web development	3.5	4.5	-1
Web development with students	2.625	3.125	-0.5
Project-based learning with technology	3.625	4.375	-0.75
Evaluating/selecting new technology	4.125	4.75	-0.625
Professional portfolio	3.25	4.5	-1.25
Learning portfolio with students	3.75	3.75	0

The overall pre-test mean of 3.59 increased to a mean of 4.29 on the post-test, indicating an increase in likeliness to use instructional technology as a result of the course. A t-test result of 8.66, when p=.01 and df=19, revealed a statistically significant increase between the mean score of the collective pre-survey and the mean score of the collective post-survey.

Of particular interest to the researchers is the breakdown of scores by questions for each of the instructional modules. The likeliness of teachers to use technology tools themselves was higher than their likeliness to have students in their classroom use the same technology tools. Teachers were least likely to have students engage in online communication and web development activities, and they were most likely to have students engage in WWW searching and multimedia presentation development. Prior to the course, teachers were least likely to have students engage in web development and digital file management, and most likely to have students engage in word processing, multimedia presentation, and online communication.

The data collected from open-ended post-survey questions and personal interviews gave a broader and deeper picture of the effectiveness of the course content and the teachers' engagement in the experience. Participants found the course to be "very useful and motivating," "a great course," "beneficial," "useful and inspiring," "enlightening," and "knowledge strengthening." Some students were very comfortable with and appreciative of the completely online format, while others suggested at least partial face-to-face additions to the course.

Many participants recognized that, while they learned a lot in this class, they also gained an increased awareness of how much they had yet to learn. One student in particular reported that they started the course with "a thimbleful [of instructional technology knowledge and skill], and now I have maybe 3/4 of a cup." This theme of "there's ALOT to learn" did not seem to result in discouragement, but rather motivated all of the students to eagerly recommend the course to others.

One important theme that emerged was the recognition of the value of instructional technology's role in pedagogy rather than just tools to be applied. One participating teacher spoke of an intention to "introduce new and different instructional techniques to students, incorporating many different learning styles and methods." Others indicated a new belief that "technology can increase motivation and provide a variety of learning opportunities" and "there is a lot more I can do and still make the learning meaningful." Yet another teacher espoused the newly formed opinion that "technology is a tool to be used by all teachers – even in PE!" The intention of using web development to showcase student work and to show progress at parent teacher conferences was expressed by one participant.

During the development phase of the curriculum content modules, the researchers included the Digital File Management section rather reluctantly, assuming most teachers would already have a good grasp of this. Surprisingly, through interviews and open-ended post-survey questions, the participating teachers greatly valued this portion of the curriculum. One teacher expressed that they "learned the value of organizing my computer. I will never again have 150 loose files in 'My Documents'." Another noted that she was now "developing a system where I can gain access to my materials and lesson plans without having to dig through a huge mess."

For teachers who tend to experience training on technology tools outside of the context of their particular classroom or personal interest, this course was appreciated for its relevance to both personal and professional needs. The 'Teaching with Technology' electronic portfolios created by the teachers were filled with evidence that participating teachers were not only competent in using instructional technology tools, but they had also emerged from the course with an overall sense of confidence and understanding in their ability to improve student learning by both modeling the use of instructional technology tools and incorporating them into learning activities.

Conclusions

Findings indicate a high degree of effectiveness of the content offered in the *Tech4u.org* professional development course. The 'Teaching with Technology' electronic portfolios served as excellent tools for showcasing accomplishments and possibilities. Further research is suggested to determine what changes these teachers actually make over an extended period of time in their teaching and learning practices that can be attributed to this course.

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Evaluation of Student Expectations and Experiences with On-Line Courses

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Abstract

Pre- and post-evaluations were used to evaluate student's perceptions of on-line courses. Inquiry focused on three primary areas including a.) interaction with course content and instructors, b.) accessibility of resources in an on-line environment, and c.) perceptions of on-line course engagement. Findings indicated that students both anticipated and experienced positive interactions with course materials, graphics, visuals, and instructors. Additionally, students anticipated and experienced adequate access to needed resources including support personnel. Finally, students favorably perceived course design components. Overall, students valued the flexibility of using on-line technology and thought the course was well organized and met their expectations.

Introduction

Facilitating the learning process in on-line environments is a new and important competency for university professors. At the University of Houston (UH), the third largest comprehensive public research university in the state of Texas, this is a challenging opportunity. The University of Houston has 33,000 students, of which 49.3 percent are minorities (Smith, 2003). Ninety percent of the students live off-campus and face many obstacles in driving to an urban university located near a busy downtown business district. This scenario provides background for UH's distance education endeavors. The Consumer Science and Merchandising (CSM) program, in the College of Technology, was one of the first programs to offer on-line content courses. Knowing that facilitating the learning process in on-line environments was going to be a new challenge, four CMS professors decided to conduct pre- and post--evaluations of their course designs.

Conceptual Framework.

Course design is a major component of any distance education initiative. Thompson (1999) stated that close attention to curriculum design and delivery is of critical importance to successful e-learning interventions. Porter (1997) related that one of the greatest strengths of distance learning lies in the different formats by which information can be presented. Goodwin (2000) added to the importance of course design by stating that instructor and curriculum quality, whether training in a traditional classroom, two-way video conferencing, or via a web-based environment, ultimately determines the effectiveness of a training or education intervention. Pallof and Pratt (1999) shared that the instructor has four roles in the on-line class: technical, organizational, social and intellectual. All four roles are intertwined with course design, as all roles focus on ensuring that learning occurs. Hall (2000) contended that a good curriculum can potentially make up for poor quality media, but it doesn't work the other way around.

Given the importance of course design in on-line environments, students' expectations of and experiences with course design is critical to ensure effective learning. Realizing that evaluation can have various foci, such as testing of knowledge or skills (Banta, 2002), professors need to ensure that their evaluation efforts also provide feedback about their own performance in designing the on-line courses. Students should be given the opportunity to reflect on the learning process and provide feedback about the course design. Wade (1999) described student evaluations of instruction as "one of our most consistent and, we have traditionally thought most strong indicators of course quality" (p. 95).

Evaluation of student expectations is crucial as it gives professors opportunities to adapt their course design to better facilitate learning. Kaynama and Keesling (2000) shared that in developing their web-based Internet marketing course, they used a technique called "assessment quality circle" to gather information from students on their reactions to the learning experiences. The evaluation technique revealed the need for additional class time to work within groups and the need for experts to provide, in advance, an outline of their presentations. This was important for design revisions. Kaynama and Keesling (2000) concluded that this integrative evaluation program facilitated continuous improvement in the instructional delivery and learning process. Bennion (2002) in his article on evaluation stated that a biology professor was able to bridge classroom experiences and problem solving based experiences after receiving feedback in midterm course evaluations that the two types of activities seemed disjointed. Bennion (2002) continued that course design is an ongoing exploration, revealing new ways to help students achieve faculty expectations. Indeed, creative forms of early evaluations need to be adopted by professors of on-line education. On-line courses, because of the lack of face-to-face contact between instructor and student, require special efforts in order to obtain information regarding learner expectations and satisfaction. Neal and Ingram (1999) suggested that what students have learned and their level of satisfaction with distance learning courses remain largely unanswered until the traditional end-of-course evaluation forms are completed and reviewed. Special attention must be given to obtaining student feedback before and during the course implementation.

Summative evaluation, while it should not be the sole point of feedback, it is also critical. While summative evaluation cannot impact learning during the current semester (Robles & Braathen, 2002), it can provide suggestions on how to redesign the course to best meet the content and process needs of future students. Lee, Owens, and Benson (2002) highlighted the evaluation strategies of a web-based MBA program jointly developed by a Fortune 500 consulting organization and the business school of a major research university. In particular, weekly survey data collected from students during the course were content analyzed at the end of the term for overall trends. This summative analysis led to a program structure change from four courses per 15- week semester to two courses per 8-week mini-term. In evaluating courses from an on-line Master of Education program at the University of Illinois, the Instructor and Course Evaluation System (ICES) was used to evaluate the overall quality of the courses. The ICES, however, was just one instrument in a broad program evaluation initiative (Levin, Levin, Buell, & Waddoups, 2002).

Evaluation is an important element in determining course design quality. While on-line course design is a new competency for most professors, pre- and post-evaluation is not. On-line environments can allow flexible and just-in-time feedback loops that professors must strategically and creatively use to learn more about their competence in on-line course design. Feedback on interaction with content, peers and instructors, accessibility of resources, user interface, and communication mediums, for example, would allow the instructors to better meet the learning needs of their students.

Purpose

The purpose of this study was to describe students' perceptions of on-line consumer science and merchandising course design. The following three questions guided this study:

1. What are students' perceptions of their interaction with course content and instructors in an on-line environment?
2. What are students' perceptions of accessibility of resources in an on-line environment?
3. What are students' perceptions of on-line course engagement?

Research Design

This study focused on pre- and post-evaluations of nine sections of seven on-line courses in an undergraduate consumer science and merchandising program. A total of 191 students were enrolled in the nine sections. The following describes the sample and population, instrument, data collection procedures, and data analysis.

Sample and Population

To answer the proposed research questions a convenience sample of 191 students enrolled in nine on-line sections of seven courses in the Department of Human Development and Consumer Sciences was selected. The sections used for this investigation included spring, summer and fall terms for 2002. The population was students enrolled in on-line courses leading to a Bachelor of Science in Consumer Science and Merchandising. The university in which this study was conducted is a large, state-supported urban institution of approximately 33,000 students. One of the sections included was a freshman level course; three of the sections included were sophomore level courses; three of the sections were junior level courses; and two of the sections were senior level courses.

Instruments

Pre- and post-evaluation instruments were designed specifically for this project. The pre-course evaluation contained 16 closed-ended format questions. Seven of the questions were demographic in nature including items requesting input on gender, class standing, major, ethnicity, employment, and course load. The other nine questions asked for students' perceptions of their anticipations regarding such factors as interactions, accessibility, and design of instruction. Student perceptions were collected using a Likert-type scale of strongly agree, agree, disagree, and strongly disagree.

The post-course evaluation included 23 closed-ended format questions. The first seven questions were identical to the demographic questions included on the pre-course tool. The additional 16 closed-ended questions solicited students' perceptions of their course experience. Seven of those items were similar to items asked on the pre-experience survey. Again, factors such as interactions, accessibility, and design of instruction were included as well as items designed to assess overall satisfaction with the course.

Data Collection

Using the pre-course instrument, data was first collected at the beginning of the semester. The instrument was placed on the course website and students were directed to complete it. Then, at the end of the term, students were given access to the post-course instrument and instructed to complete it. Students completed the instruments at their own worksite and at their convenience.

Findings

Data Analysis

Preliminary analysis of the pre- and post-experience data was accomplished via the quiz and survey capability of the course software. The delivery medium used for these courses was WebCT. Following initial review, the data from the closed-ended questionnaire items was evaluated by univariate frequency distributions. For these closed-ended items, response categories agree and strongly agree, and disagree and strongly disagree were collapsed to become agree and disagree. This was done to enable a generalized view of students' perceptions.

Comparing Pre- and Post-Experience Perceptions.

Following initial analyses, the seven similar questionnaire items from both the pre- and post-course instruments were compared. Percentages were calculated to aid in the comparison. Then, to enable further examination and interpretation, the data was clustered by content areas that corresponded to the three research questions. The Paired Proportion Test for Dependent Samples was used to test for significant differences between anticipated and experienced scores.

Results

Respondents were predominately female (73.30%) and college seniors (59.16%). Majors enrolled in these consumer science and merchandising courses included Consumer Science and Merchandising (24.61%), Human Development and Family Studies (10.47%), Human Nutrition and Foods (11.52%) and other (49.74%). Ethnic distribution included white (39.79%), African American 28.80%), Asian American (16.23%), Hispanic (10.47%) and International (2.09%). Students were employed more than 20 hours per week (71.73%) and were enrolled in 10 or more credit hours (67.01%) (see Table 1).

Research Question #1: Students' perceptions of their interactions with course content and instructors.

Findings related to Research Question #1 indicated that students anticipated (83.77%) and experienced (85.18%) ease in paying attention to the instructor's materials on the computer monitor. They anticipated (94.24%) and experienced (79.89%) the ability of the instructor to pay attention to students on the web. Anticipation and experience with other interaction aspects was also positive: ease of reading graphics and visuals (positive anticipation, 92.14%; positive experience 91.54%), ability to pay as much attention as in a regular course (positive anticipation, 87.43%; positive experience, 73.55%), instructor answering questions (positive anticipation, 92.67%; positive experience, 83.02%). Similarly, while not included in the pre-experience instrument, reflective summative responses also indicated positive perceptions of interaction aspects of the on-line courses. Class examples and activities were viewed as helping the student to learn (78.31%) and students felt that the faculty seemed knowledgeable about all course topics (78.84%).

To analyze the differences observed in anticipated and experienced percentage scores the Paired Proportion Test for Dependent Samples was run on three pairs of data with differences large enough to merit analysis. These pairs included: "Ability of instructor to pay attention to students" (94.24% anticipated, 79.89% experienced), "Ability to pay as much attention as in a regular course" (87.43% anticipated, 73.55% experienced), and "Instructor answers question" (92.67& anticipated, 83.02% experienced). Analysis showed that only at the .1 level were percentages for the items "Ability of instructor to pay attention to students" and "Ability to pay as much attention as in a regular course" significantly different. Analysis of the item "Instructor answers questions" did not show significant differences in percentage values (see Table 2).

Research Question #2: Students' perceptions of accessibility of resources.

Relating to Research Question #2 findings showed that students both anticipated (91.63%) and experienced (90.48%) adequate access to resources needed for the class. Support personnel were also seen as readily accessible (anticipated, 77.49% & experienced, 53.44%) (see Table 3). (Approximately 30% of the post-experience respondents thought this question did not apply. Thus, tests for significance were not performed.)

Research Question #3: Students' perceptions of their engagement with on-line courses.

Only one of the instrument items solicited comparative pre- and post-course data regarding perceptions of on-line course design. The ability of students to pay as much attention in the on-line course as in a regular course received ratings of 87.43% (anticipated) and 73.55% (experienced). (For implications note that more experienced students did not feel the question applied).

Students' General Satisfaction.

Following students' on-line experience, several additional questions were asked and tabulated. Eighty-one percent (81.48%) agreed that the flexibility of using on-line technology helped them learn the course content. Only 12.69% disagreed. Course organization was also assessed. About 75% of the students thought their course was well organized. Just under a quarter (22.75%), however, disagreed that their course was well organized. Testing was also evaluated with 81.86% reporting that testing was handled appropriately. Only 7.94% disagreed with the handling of testing.

When asked whether the course content met students' expectations, 79.37% responded positively while only 14.82% responded negatively. Additionally, 77.78% of the students stated that they would tell their friends to take an on-line merchandising course while only 12.7% said they would not. Similarly, 73.02% stated that they would take another on-line merchandising class themselves while 17.46 said they would not.

More globally, student anticipation and perception of their overall satisfaction with the on-line experience were favorable. Pre-experience evaluation scores were nearly 90% favorable with only 6.81% unfavorable. Correspondingly, post-experience evaluation scores were nearly 80% favorable with 15.88% indicating dissatisfaction (see Table 4). In general, students' anticipation scores were somewhat higher than experience scores. Reasons for this difference merit further investigation including whether the discrepancy may be due to unrealistic expectations. Lower experience scores may reflect an adjustment to the reality that on-line courses are not easier than face-to-face courses rather than that courses have poorly designed components.

Implications

In general, these findings indicate that students held positive perceptions of on-line courses. This was true both as they anticipated taking an on-line course and as they had experience with that course. This perhaps suggests, first, that there are not insurmountable barriers for students to taking on-line courses. Second, it suggests that for these specific courses the experience was generally positive. From these two factors it may be argued that on-line coursework may be a positive, viable option for delivering course content to students.

Interactions

From the data generated by the cluster of questions related to students' perceptions of their interactions with course content and instructors, it may be implied that students had positive interactions. Student responses indicated that they were able to pay attention to course materials. In fact their summative responses were even slightly more positive than their pre-experience responses. Additionally, most expressed that they were as able to pay attention in the on-line course as well as they had in face-to-face courses they had taken. This implies that students did not feel that it was necessary to have physical or face-to-face interactions with an instructor or the course content in order to pay attention. This finding may alleviate faculty fears relating to student inattention and free them to concentrate on the development of excellent on-line strategies.

Predominately, students also anticipated and experienced the ability of the instructor to pay attention to them in the on-line course. This suggests that faculty appear ready to help students and to respond to their needs. A slight drop in ratings between anticipation and experience, while still positive, indicates that there may be an opportunity for faculty to be more responsive to students and perhaps to incorporate more interaction between students and instructors into the course. This may also apply to the way in which faculty answer student questions. Strategies to encourage and facilitate effective faculty-student communication could be developed. These could include course format design, curricular solutions, and faculty training.

Student's positive responses to other interaction issues such as ease of reading graphics and visuals and class examples that helped students to learn suggest that current course design elements are meeting students needs. This finding has merit because it suggests that present efforts to develop effective courses are being successful. It does not, however, imply that current strategies and techniques will remain effective or even adequate. Both students' levels of sophistication and changing technologies will demand vigilant attention to the development of ever-superior graphics, visuals, curricular elements, and the technology to deliver them.

Finally, with regard to interaction issues, this study reports that students felt that the faculty was knowledgeable about all course topics. This, too, is a positive finding. It reflects student confidence in the knowledge held by the instructor and may, perhaps tenuously, be extrapolated to suggest that faculty were effective in sharing that knowledge or in creating a learning environment where students could develop their own knowledge base. As such, the ability of faculty to couple their own knowledge with the capacity of on-line delivery strategies to enable students to have productive interactions with subject matter is a positive finding. This finding is well worth exploring, as technology advancements will continue to challenge this potential.

Accessibility

The cluster of questions regarding students' perceptions of the accessibility of resources had two components. First, responses indicated that students both anticipated and experienced adequate access to the resources they needed for the class. While the question itself is not specific in the type of resources referred to, perhaps the message of the responses is that resources can be provided on-line. Creative instructional designers, including faculty, have the capability to decide what resources students will need for optimal learning and then to provide venues for students to obtain them. This is important because with time, resource needs change. Yet, these findings imply that securing access to resources for students is, indeed, possible. Increasingly, technology may prove an excellent ally in the procurement of course materials for student access.

Second, more than half of the students in this study reported that support personnel were readily accessible. While this finding is positive, lower positive response rates to this item in comparison to other survey items causes concern. Only about three-quarters of the students anticipated that support personnel would be readily accessible. This indicates some apprehension on their part. Even more drastic is that only just over half of the students experienced readily accessible support personnel. This may indicate less than ideal service associated with these particular courses. However, the low satisfaction number may be because almost a third of the respondents did not answer this question or did not think that the question applied to them. In those cases it is possible that they, simply, had not felt the need for support personnel and therefore were unaware of whether they were available. In either case, it seems imperative that for students who need support, particularly technical support in the case of the use of new technologies such as on-line instruction, that support be readily accessible. This can be accomplished by decisions to hire support persons, instructing students on how to request support, and training faculty and staff in how to provide quality and timely support.

Learning Engagement

One component of on-line course design evaluated was the ability of students to pay as much attention in the on-line course as in a regular course. Once again, while student responses were positive, a slight drop from anticipation scores to experienced scores may be cause for concern. A question asking whether there were elements of the course design that did not meet students' engagement expectations is an appropriate addition to the summative evaluation. Other factors such as what are students' expectations, what features captivate and/or hold students' interest, etc. could also be included in future evaluations.

The findings associated with this study can provide input to future investigations. These students felt that the flexibility of using on-line technology helped them learn the course content. Further research could look at why flexibility was advantageous. Similarly, testing issues could be explored. This study made no attempt to learn which testing methods were favored but learned only that students were comfortable with the handling of testing. It would be useful to compare further the types of testing strategies used in comparison to student satisfaction and how well they measured student learning and application. Course organization could also be examined. Consideration could be given to elements such as course structure, instructions to students, orientation materials, etc.

Finally, questions such as would students tell their friends to take an on-line course, would they themselves take another on-line course, and their general satisfaction with the on-line experience have strong implications for future study and application. This study highlights many opportunities for investigation of on-line learning. Strategies, priorities, efficiencies, and expectations are all fertile fields. However, perhaps the greatest impact of this study is the clear recognition that these students perceived on-line learning positively. This can provide incentive for educators and theorists to continue to push the horizons of this new learning environment to create ever-improving modes of instruction perhaps based on these early (successful) endeavors with on-line learning.

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Table 1 *Student Demographics*

Characteristic	**Percentage**
College major	
Consumer Science and Merchandising	24.61
Human Development and Family Studies	10.47
Human Nutrition and Foods	11.52
Other	49.74
Ethnicity	
White	39.79
African American	28.80

Asian American	16.23
Hispanic	10.47
International	2.09
Employment status	
More than 20 hours per week	71.73
Enrollment status	
Enrolled in 10 or more credit hours	67.01

N = 191

Table 2 *Student Perceptions of Interactions with Course Content and Instructors*

Characteristic	**Percentage**		
	Anticipated	Experienced	P Value
Ease in paying attention to instructors' materials	83.77	85.18	
Ability of instructor to pay attention to students	94.24	79.89	.067**
Ease of reading graphics and visuals	92.14	91.54	
Ability to pay as much attention as in a regular course	87.43	73.55	.066**
Instructor answers questions	92.67	83.02	.158
Examples and activities helped the student to learn	*	78.31	
Faculty seemed knowledgeable about all topics	*	78.84	

N = 191
* Factor included only on experienced instrument

*Paired Proportion Test for Dependent Samples found these differences to be significant at the .1 level only.

Table 3 *Student Perceptions of Accessibility of Resources*

Characteristic	**Percentage**	
	Anticipated	Experienced
Adequate access to resources	91.63	90.48
Support personnel were readily accessible	77.49	53.44*

N = 191
* Approximately 30% of the experienced respondents thought this item did not apply.

Table 4 *Students' General Satisfaction*

Characteristic	**Percentage Agree**
Flexibility of technology helped them learn course content	81.48
Course was well organized	75.66
Testing was handled appropriately	81.86
Course met student's expectations	79.37
Student stated they would tell their friends to take an on-line course	77.78
Student stated they would take another on-line course	73.02
Student was satisfied, overall, with the class	79.9

N = 191

The 'New Wave' for Technology Integration in California Schools

LeeAnnStone
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Introduction

With the completion of the Digital High School Program (DHS) in 2002, California's high schools have experienced the first major wave of effort aimed at building their technology capacity. As a result of the program, student-to-computer ratios among California high schools were reduced from 16:1 (Milken Exchange, 1999) to to 5.3:1 across all California schools by 2002 (California Department of Education, 2002). Yet despite this extensive infusion of equipment and technology infrastructure, the same degree of impact has not occurred in the area of utilization of these resources. So common is this phenomenon that, several participants in the study named it for us: Technology rich, utilization poor. This paper reports findings on a study of barriers to technology integration in eight selected high schools in Southern California, and reports recommendations for the next wave of technology integration efforts.

The Research Design

The research upon which this report is based sought to identify the continuing barriers to technology integration now that the critical factor of availability has been addressed. Many other researchers have tackled this question as well (Borko & Putnam 1995; Brickner, 1995; Byrom, n.d.; Chu, 2000; Dias, 1999, 2000; Ertmer, 1999; Ertmer, Addison, Lane, Ross & Woods, 1999; Hadley & Sheingold, 1993; Hugo, 2000; Mehlinger, 1997; Montgomery 2000), most notably Sandholtz, Ringstaff & Dwyer (1997). While the findings of these earlier researchers provide a foundation upon which this study builds, they focused for the most part on a single variable—teachers and the issues they face both intrinsically and extrinsically—in their search for barriers. This study, while noting the critical role of the teacher in the integration process, employs a holistic lens that looks at a network of interrelated factors that can impact technology integration in schools.

The central research question of this study is: What barriers to the utilization and integration of new technologies into teaching and learning are experienced and articulated by students, teachers, administrators, and staff, and expressed within documents, from eight selected Southern California high schools? The framework for answering this question is derived from Lemke and Coughlin's *Technology in American schools: Seven dimensions for gauging progress* (1998); these dimensions include: the learner, the learning environment, professional competency, planning and leadership, community connections, technology capacity, and accountability. A series of additional questions incorporating these dimensions were established to serve as objectives in answering the main research question. Five of the eight questions are the focus of this report, and are detailed in Figure 1. Employing this framework in the investigation of barriers to integration allows for a systemic exploration through multiple lenses, and provides an opportunity to build a comprehensive picture of the interrelationships among the myriad obstacles that present themselves in the course of technology integration within a given school.

Figure 1: Sub-questions used to guide analysis of the data

1. **The learner:** What role— from the student's perspective— do any district, school, classroom, and/or lab policies and practices play in promoting or obstructing new technologies use?
2. **The learning environment:** What are the conditions of access inside and outside the school setting, and in what ways do these conditions promote or obstruct teacher and student use of new technologies?
3. **Technology capacity**: What are the conditions of the technology capacity of the school and classrooms, and what role does this capacity play in terms of student and teacher access, availability, and use?
4. Professional competency: **What do teachers express in terms of their professional knowledge, experience, and competencies related to new technologies for teaching and classroom management, and are there any patterns of facilitations or barriers that relate to their instructional practices?**
5. **Planning and leadership:** What is the state of technology planning and leadership within the school, and how does the coordination and communication of that planning facilitate or impede the implementation: of technology integration?

The data source for this secondary analysis comes from a study for the University of California Office of the President on access, availability, and utilization of new technologies in California high schools (Knobel, Stone & Warschauer, 2002). Table 1 outlines the type, counts and form of the data used in this secondary analysis.

Table 1: *Inventory of Data Type, Counts, and Forms*

Data type	Quantities	Forms
Teacher interviews	59	Audiotapes, filed notes & transcripts (both electronic and hard copies)
Administrator & staff interviews	15	
Student focus groups	9	
Classroom observations	79	
Student questionnaires	1052	Original questionnaires & FileMaker Pro database of responses
Artifacts & documents	122	Copies of documents

Three analytic techniques were employed with this data: (a) emergent pattern matching as applied in the ethnographic tradition (Fetterman,1998; Knobel & Lankshear, 2001; Stemler, 2001; Yin, 1994), (b) *a priori* pattern matching, and (c) counts and correlations. Emergent pattern matching allows for the identification of themes and patterns that may not have been previously identified, while *a priori* provides the researcher the opportunity to build upon the findings of previous researchers. Counts and correlations were employed to reveal any relationships among the demographic data, as well as triangulating data found through the pattern matching processes.

Findings: The Barriers

The Learner

Student responses to survey questions— particularly the open-ended questions— and their comments from focus groups provided an opportunity to access information about technology implementation (or lack of it) across the school, via the students' experiences with a wide range of courses and teachers. Such data is extremely sparse among the literature on the topic, first because the students' perspective has not been the focus of much research interest, and secondly—if the experience of this research project is any indication—due to the difficulty in getting access to students through district policy and Institutional Review Board processes. Yet the 1,082 student surveys, with their combination of closed- and open-ended questions, provide a wealth of information about students' attitudes and sources of information about, and uses of new technologies. Additionally, the comments of the 49 students who convened in 9 small group interviews provided a means to triangulate with patterns identified through the more extensive student survey data, as well as from other interviews and documents. Analysis of this type of qualitative data goes beyond the more commonly-applied quantitative approaches of equipment, student, teacher, and infrastructure counts, and appears to be the next wave of research into the topic. Indeed, in addition to current calls for deeper exploration into new technologies integration, which include in-depth qualitative approaches (Knobel, Stone & Warschauer, 2002), California's Technology Assistance Program (CTAP) has begun including some of these qualitative elements in its annual survey of California schools.

From whom do the students learn? Across multiple variables within this study—across schools of varying socio-economic status, and across levels of home ownership of computers— students reported learning more about computers from themselves than from any other source. With a few exceptions, teachers ranked fourth after self, family, and friends in terms of influence on student learning as it relates to new technologies use. The question eliciting this data, "Who has taught you the most about how to use a computer?", consisted of a five-point Likert scale, with 1 indicating "Not much" learning from the source, to 5 indicating "A lot". Table 2 provides a summary of the contrasts between the high and low responses among the data. To arrive at the schema below, the number of responses in the 1 and 2 range (below the midrange) were counted and compared with the total of those responses above the mid range (i.e. 4 and 5). The data can be read thus:

++ There is a 100% difference or more between the number of responses at the high end of the scale ("I learned a lot from this source") and number of responses at the low end ("I didn't learn much").

+ There are more responses at the high end of the scale than at the low.

= The difference between number of responses at either end of the scale are equivalent or within 4% of the total count for that category (e.g. 43 low and 41 high equals a 2.3% difference between the counts, placing it in the roughly equivalent category).

- There are more responses at the low end of the scale than at the high.

-- There is a 100% difference or more between the number of responses at the low end ("I didn't learn much") and number of responses at the high end of the scale ("I learned a lot from this source").

Table 2: *Student Self-Reported Sources for Learning Computer Use*

Learn about computers from:	Bergenia	Cassia	Dalea	Erica	Escallonia	Kalmia	Salix	Vallota
Self	++	++	++	++	++	++	++	++
Friends	=	+	+	-	++	+	+	+
Family	+	+	+	=	+	=	+	+
Teachers	+	--	--	=	+	--	-	--
School librarian	--	--	--	--	--	--	--	--

When schools are ranked in terms of rates of home ownership and that ranking is compared with student ratings of the impact teachers have on their computer learning, an inverse relationship between the two emerges. That is, students at schools with lower home ownership rates rank teachers as more influential in their learning about computers than do students at schools where the rate of home ownership of computers is higher (see Table 3). Ironically, however, teachers at schools with lower rates of student home ownership of computers reported assigning less computer-involved work both at school and at home than teachers at schools with higher rates of home ownership. Thus, those students who rated their teacher's influence as higher actually had fewer opportunities to be involved with technology-based learning. Teacher and administrator interviews at schools with lower rates of home ownership revealed that their reduced assignment of technology-based homework was an explicit teacher or school policy designed as a means to not disadvantage students who may not have access to computers at home. Without exception, teachers and administrators at these schools estimated that only 50% of their students had home access. Not only did students report significantly higher rates (Table 3), but many who do not have home computers stated that they had a variety of options for access (including friends, family and libraries), and that doing so is not a problem in terms of completing assignments. Thus, students who most looked forward to learning from their teachers, had the least opportunity to do so due to policy based upon faulty (yet honorable) assumptions.

Table : *Relationship between Home Ownership of Computers and Teacher Influence on Computer Learning*

	Low-SES schools					Higher-SES schools		
	Escallonia	Bergenia	Erica	Salix	Kalmia	Dalea	Cassia	Vallota
Learn from teacher	+	+	=	-	--	--	--	--
Home ownership rates	74%	75%	83%	92%	94%	98%	99%	100%

The Learning Environment and Technology Capacity

The capacity and conditions of access within the learning environment weave around one another as factors that influence to what extent both teachers and students utilize new technologies. Capacity refers to the infrastructure of networking and support, as well as actual inventories of equipment within a given school environment. Until recently, capacity has been the primary focus of research in the area of technology integration. Annual counts of computers and internet connectivity (e.g. CTAP data) have represented the key criteria for determining degree of technology integration within California schools. However, such counts alone provide only a glimpse of the overall structural framework of new technologies within a school, and provide no real information about how that infrastructure is accessed, nor what is done with it (Knobel, Stone & Warschauer, 2002).

Table 4 provides a summary of student-to-computer ratios at the schools participating in this study. If all that were available were this data, one might surmise that the schools with the lower student-to-computer ratios had, perhaps, the most extensive and integrated uses of new technologies. This, as the current research found, is certainly not the case. In fact, Salix High School, with the lowest ratio among all participating schools, also had the lowest level of observed technology use. Many factors contribute to rich usage, beginning with how easily, or with how much difficulty, technology can be implemented within the instructional and learning processes.

Table 4: *Student-to-Computer Ratios at Participating Schools*

	Salix	Cassia	Escallonia	Kalmia	Dalea	Bergenia	Erica	Vallota
Computers for instruction	600	667	327	541	688	680	506	300
Students per computer	3.3	3.7	3.7	4.0	4.2	4.5	5.7	7.8
Internet connected computers	600	453	327	357	459	321	506	300
DHS start year	1999	2000	1999	1999	1998	2001	2000	2001

Note There is no evident correlation between student per computer ratios and low- or high-SES status or between DHS start date and student computer ratios.

Teacher access. Although Digital High School grants require at least one internet-connected computer per instructional space, the reality of physical growth and layout at many campuses results in schools not meeting this requirement. Capacity in the form of internet connectivity is impacted negatively by the ongoing ad hoc growth of campuses via portable classrooms (Bergenia, Dalea, Kalmia, Salix), as well as scheduled renovations (Salix), and major expansions (Bergenia). 60% of Bergenia's classroom spaces are housed in portable buildings with no internet connectivity, and at Kalmia, 29 out of the 91 classrooms are added portable facilities. Not only does Salix have a village of portable classrooms, but due to a major renovation project, full departmental wings of classrooms are currently disconnected from internet access; one-third of the campus has no internet connectivity. Two teachers at Bergenia mentioned that last year they had internet connectivity and no computer, and this year the reverse. Such capacity issues directly impact teacher's abilities to plan for and implement new technologies use.

Thus, teachers in the study had access that ranged from only one stand-alone computer to 25 networked and internet-connected computer stations in their classrooms. The range of access by teachers and their classes to computer labs was equally as wide. At Bergenia, teachers are not even afforded the opportunity to schedule use of the lab to fit into their instructional needs. Rather, they are assigned lab times by a non-teaching, part-time lab monitor. Teachers can attempt to swap assigned times with other teachers to fit use into their curricular needs. On the other end of the spectrum, English teachers at Dalea routinely, and even without advance notice, share and exchange classroom spaces depending on need.

Security procedures, in particular security of the system from hacking and/or posting of inappropriate materials (whether due to copyright or content), create access issues for teachers. Many of the complaints from teachers and technology coordinators, such as the following by the Media Resource Specialist at Kalmia, included references to cumbersome and convoluted district policies:

> [T]hey [the District]want us to have all of our web pages, the school web page, as well as the library web page on the District server for protection. My web page was originally on the District server, but they put so many obstacles in my way and hindrances that I decided not to put it there anymore. Originally, to put it up there, you had to learn the special program that they had…stupid program that was very difficult to learn, and the only one that knew how to do it was one person on campus. That was me and I had to learn from them and they just told me how. Anybody else needs anything else on my web page, you gotta come to me and get the password and I have to upload it for 'em....Anytime I wanted something on the internet, I had to go to my principal and get approval. And then I would email the guy at the District and he would email my principal to get approval. The principal emailed him, "Okay, I checked it out. It's okay to put it out.", and he would put it out. Weeks would go by sometimes.

As a result, the Media Specialist at Kalmia made a unilateral decision to host the school web site at his own expense. Media Specialists at at least two other schools in the study made similar decisions. Not only did they feel that they could maintain more consistent uptime on their systems, but they found it much easier and quicker to make regular, even daily, changes to their web pages. This is an increasingly important factor if web pages are to function as effective providers of up-to-date information and communications.

Physical plan. Data from this study illustrated how the physical layout of campuses can obstruct or provide affordances for collaboration, which in turn can facilitate advancement of teacher professional capacity and integrative use of technology. At Dalea High School, departments are housed mostly in distinctive wings, each of which provides common meeting spaces housing desks, bookshelves, and kitchenettes for teachers. In the English Department, for example, teachers routinely, and even without advance notice, share and exchange classroom spaces depending on a teacher's and his or her class needs for the day. Indeed, the other schools where high levels of regular teacher collaboration were observed had similar architectural layouts (Escallonia and Cassia). These are also the schools that demonstrated the most frequent and integrative uses of technology within their curricula.

Bergenia presents a striking contrast to the compact and collaborative environment of Dalea, Cassia and Escallonia. One trailer village (housing science classes) sits on the far end of the football field, and access to those rooms is locked off by a 10-foot high fence between class periods. Another crop of portable classrooms occupies the basketball and volleyball courts. Teachers at the campus cannot tell visitors how to find rooms outside of their immediate vicinity. The campus is so large both in terms of student population (over 3000 students) and in geographic sprawl, that campus communications in general are strained. The Assistant Principal related the situation in this way:

> When I went into administration, and people said where did you come from, and I said Room 7b, and they said, "You've been here at the school?' They didn't know I was at the school. It's like a small city. We've just had this tremendous, between growth and retirement, big turnover in our staff. So people don't know, "Where can I find Mr. so and so…?" "I don't know, I've never heard of that person". I've had people say to me, "Who was that you were talking to? Does he work here?" "Yes", because of the way it's laid out. And we don't have a lot of staff meetings. The principal just didn't believe in calling meetings. So people don't see each other. The size of the campus is a barrier because it's so large that networking is an issue.

.
The physical layout of schools, therefore can create both barriers to physical networking (i.e. inability to provide internet cabling) as well as barriers to the collegial networking that allows teachers to share resources and ideas, and to build upon one another's practice.

Technical support. Concerns about the unpredictability of staffing funds plagued technology coordinators and administrators across the data set. The Assistant Principal at Cassia High School summarized it thus:

> What's going to really happen to technology cause it scares me to no end. The district is basically saying that, "It breaks, you're going to fix it, pay for it." That's great as long as the funds are there, but you're not necessarily guaranteed those funds being there forever. And there are places you can go to see where all the leftover computers are. There's piles of them here and there that are just categorized for parts...We need more support, but the fear of funding cuts probably really diminished that...Until we know there's going to be money in the future, we kind of cut back on purpose for putting another technician in the school site to do a lot of the maintenance so that we can eventually free up more teachers to do more training on an ongoing basis. That's what was really going to happen.

A few schools, such as Vallota, Dalea, and Erica, had begun the new technologies integration process long before the DHS push. As a result, the network infrasture was mature and the support team had more experience in handling issues related to that support. At most of the schools in the study, however, such was not the case. DHS funding represented one of the biggest grants the schools had ever received, and so many went from having a dozen stand-alone computers throughout the campus to hundreds of networked ones. The technology capacity at Kalmia High School, for example, grew from 20-30 Apple IIe computers and a Mac Classic keyboarding lab, to over 500 computers in a couple of years. Other schools in the district went through similar changes, and yet, as the Media Specialist at Kalmia explains, the staffing infrastructure did not grow accordingly.

> There were [only] two guys for PC and two guys for Mac. And then there were three guys for AV stuff [at the District offices]…that were available to come out and do networking stuff…And then there was the Network Administrator and the Director of Information Systems people in that office downtown. But people who actually could come out and work were two PC, two Mac, and really two guys who would actually come out our office for AV stuff. And that was it. And that was for eight high schools, eight junior highs, three adult ed campuses, the Academy, and the District Administration building. And again, you got a District that went from, I don't know, district-wide, how many computers, but now you're talking about thousands of computers around here in the District. And it happened over about a two-year period.

In response to the need for support staff that includes both technical and pedagogical support, as well as planning units, Dalea High School has established for itself over time what can be viewed as a tapestry of interconnected support networks. Through this network, the campus has created a cadre of technology-competent teachers who themselves can “train up” as the Media Specialist phrases it, other teachers on campus. This scenario, however, highlights the situation that all campuses face to some degree: that necessary support comes in the form of committed teachers and other campus personnel who add, often without additional compensation, to their already multiple assignments. Schools that have not established networks of technology support teams—and that is most of the schools in this study—are at extreme disadvantage in meeting the support needs of the school in light of the shortage of funding support, in particular, the deferment of TSST funds.

Class schedules. Becker's (2000) finding of more frequent use of computers during class time by teachers on block schedules than those on traditional schedules was observed in this study as well. Of the participating schools, Cassia, Dalea, Erica, and Vallota all function on variations of block schedules. In addition to simply providing longer periods to do extended activities, block schedules provide affordances for accommodating the time consumption that using new technologies often entail. In an interview, the technical coordinator at Dalea High (a school that has not implemented a block schedule) explains the barrier that short class periods create:

> The short period is a barrier. In terms of using technology…particularly if you’ve got 200 kids, 250 kids logging into the Mac server in the first 10 minutes, and the same thing on the PC server. If you’ve got that many kids logging in on the PC server, sorry, there goes your first five, ten minutes, maybe. If there’s something wrong. And if the server goes down, sorry, there goes 15, 20 minutes and by the time you got any work down, it’s time to save. …So there’s a lot of time when teachers and students will lose a whole period if there’s even a minor technical difficulty just because by the time they get a hold of us, then it gets taken care of – I mean, we have what in industry would be a bitchen turn around time, you know, if you lose a half hour, who cares. Go make your coffee. Who cares. You go back to work. You lose a half hour in a 55-minute period, your day’s shot. Especially if it takes 10, 15 minutes to talk to the kids and then get them in the lab.

Vallota’s block schedule is unique in providing 45-minute office hours twice a week. During these office hours, students are permitted to meet with teachers and/or work on individual or group assignments, in the computer labs if necessary. Although these office hours were not designed specifically to provide students on-campus computer access time, teachers and administrators at Vallota alike mention the ways in which these periods contribute to student access.

Student access. Access means more than simply whether can one get to a given piece of equipment; it also relates to once there, what one can do with it. At Vallota students are not allowed to use school facilities for personal email. At Bergenia, students are not allowed to use two of the labs for any independent work of any type. Other restrictive policies among the study schools include cumbersome and time-consuming check-in and check-out policies that discourage student use, prohibitions on students helping other students at their computer, and limited distribution of computers throughout the school. On the other end of this range of student access issues is Erica High School, where the administration has an open policy allowing students to explore new technologies resources on their own terms. A snapshot of what such access looks like at Erica follows in Figure 2. While all of these schools have limited computing resources, each has made different decisions regarding allocation of access to these resources by students. Erica, with the second-highest student-to-computer ratio, has nevertheless made the decision to extend access for other than focused academic activities, a decision that allows students to explore ways in which technology relates to their own interests and daily lives.

Professional Competency

The data from this study disproves the popularly expressed belief that older teachers are generally reluctant users of technology. It is also popularly assumed that younger, less tenured teachers generally have used computers more in their own school and teacher training experiences than tenured teachers for whom personal computers did not exist in their school days. These assumptions were disconfirmed by the data from this study. On the contrary, a large percentage of participating teachers had both significant numbers of years of teaching experience (averaging approximately 17 years) as well as placement at their current school (averaging 13 years). 37% of teachers participating in this study have taught for more than 20 years, with eight of those having 30 years or more of teaching experience. This finding coincides with other studies that have found that teacher’s uses of classroom technology evolve as they gain experience (Ertmer, et.al., 1999; Hadley & Sheingold, 1993; OTA, 1995).

Figure 2: Learner Access at Erica High School

A dozen or more students are lined up waiting for a computer to be vacated as others, who managed to arrive only seconds earlier than these, are already deep into their computer activities. The lab is quiet— not as a result of regulations— but as a consequence of the students' interest in the sites they are at. A scan of the monitors reveals that few of these students are working on school assignments. One student is checking out the World Taekwondo Federation, another a wrestling site, several students are at games and music pages (eZone games and KROQ among them), while a car sales site and an online clothing page occupy two other students' attention. Six of the 23 students are logged onto the Erica High School web page, although some perhaps for social information (games schedules, homecoming activities) rather than schoolwork. Of these 23 students, 17 are young men and only a quarter are young women.

The labs are open to the students to use on a first-come, first-serve basis regardless of their purpose in using them. This contrasts significantly with policy at other schools in the study where students are warned through many modes that computers are for schoolwork only. The Principal, Assistant Principal and Librarian at Erica all concur that "letting them play" is ultimately a productive route towards academic integration.

Adapted from: Knobel, Stone & Warschauer, 2002

Mehlinger (1997) concluded that even when teachers have easy access to computers and plenty of training, it takes at least three years before they feel comfortable enough to begin thinking instinctively about how to incorporate these into their lessons. Hadley and Sheingold's (1993) data suggested an even longer time of 5 to 6 years. Thus, the disadvantage, as the data from this study illustrated, actually lies in being a novice teacher.

A comparison of novice teachers to more experienced ones within the study highlight the role that experience plays in allowing teachers to venture into new teaching domains. Meskill, C., Mossop, J., DiAngelo, S., & Pasquale, R. (2002) conclude that:

> experienced teachers who use technologies effectively with their students can be broadly characterized as viewing technology as a means rather than an ends to learning (Garner & Gillingham, 1996), that they see themselves in a mainly advisory role (Meskill, Mossop, & Bates, 1999; Norton & Gonzales, 1998), and that as professionals they welcome newness and variety, and continually seek to expand their repertoires (Berg, Benz, Lasley, & Raisch, 1998). Novices, on the other hand, feel they must first and foremost master the routines and rituals of new contexts (Kagan, 1992). When these contexts include mandated technologies use, there is risk of non-reflective appropriation. (pp. 46-47)

Differences between the discourse of novice versus experienced teachers from the data of this study confirms this finding. Here is what a novice, not-yet-credentialed Science teacher from Bergenia High School has to say about integration of new technologies resources into his curriculum:

> [I]f I spend a couple of days or one day a month in the computer lab, then that's one day I'm not covering the content, we're not doing a lab, it doesn't count as a lab. For UC purposes, we have to be doing 40 % labs and that's a really tough one to pull and so it takes me out. It's not a lab day, they're not working on the…or whatever…a writing. It's a technology thing, which is useful for a job, but it takes me away from doing other stuff. And so I've never in my four years taken them into the computer lab.

Yet a more experienced science teacher from Erica addresses the same issue in a very different way:

> We have so much breadth that needs to be covered and so you don't have that much time to go in depth for each topic. I don't know if it's just individual to our subject, I mean, that could be true for any subject, I think. And really, that's where it comes down to determining and making a personal decision: Okay, I think my students are going to get a lot more out of doing this activity and if I don't get it covered this one topic as much as I should…you're constantly thinking these things. There's no way you can follow a book exactly the way it is, which is exactly what we have to cover. I mean, we have our guidelines to set the pace

> and our curriculum, this is what should be covered, and one thing leads to another. But it's never going to be the same curriculum. And I think that's our job. We've been trained to be able to make those decisions.

This is one way in which being a novice teacher can create barriers in the technology integration process. Another related factor lies in the level of networking and collaboration that a teacher is involved in. A Bergenia Science teacher (an as yet uncredentialed teacher), for example, complained in his interview about the absence of centralized repositories of information and materials related to internet-based resources for Science instruction tied directly to California's standards. An experienced English teacher in an interview that immediately followed, on the other hand, effused about S.C.O.R.E., an online resource for electronic lessons designed around California's curriculum standards (including Science standards). The difference therein lay in the rich networks of professional colleagues and information resources that the experienced teacher had developed over the years. As a novice teacher engaged in completing his course requirements during non-teaching time, the Science teacher had not had the time or opportunity to yet develop such collaborative networks.

Planning and Leadership

The role of technology. In her case studies, Barbara Means (1995) found that a deciding factor in successful implementation of new technologies was the creation of a coherent schoolwide approach to using technology in the core curricula for all students. The data in this study found that despite such detailed school-developed technology plans, there existed wide differences among teachers and administrators, and between teachers and students relative to the role of technology in the classroom. At Salix, for example, the DHS coordinator cited his long-term technology goals for the campus to be that "computers become an everyday part of the curriculum, not just in the computer classes [as they currently are]." However, observations of classes did not substantiate this goal. Most disturbing from the classroom observations was the finding that students' acquisition of discrete technical skills, such as cutting and pasting, and creating and positioning graphic elements into a Word document, were taught and performed by students devoid of any meaningful content or context. Furthermore, while the role of technology in non-core classes such as journalism, art, music, yearbook, and computer graphics is direct and explicit, it is more frequently seen as an extra element in the core courses of English, Science, Math, and Social Studies. Cassia High School's assistant principal stated that technology is "not a critical status of the academic areas." School staff must have a clear understanding of the role of technology within their curriculum before they can begin to communicate and apply these goals to student learning. At a number of the schools in the study these understandings have not been jointly communicated, there is little common discourse or understanding, and the stated aims in the Digital High School grant applications and/or technology plans are in opposition to observed practice.

Communication. What are the results when there is no overall campus communication and leadership? The situation at Salix is one example. Another example comes from Bergenia where at least three different campus units work relatively independently of one another in providing for student access to lab computers. In this case, two of the three campus computer labs run by the Project Office had internet connectivity provided through DHS funds. However, as a result of legacy issues— the labs previously had not had such connectivity, and each was designated for a particular set of functions— students were not allowed to use the internet in these facilities. This situation lasted for 5 months into the academic year before being resolved. The only reason students were not allowed access was because they never had it before and no one had given a directive to the Office or the lab monitors that they could make such changes to policy. A break in communication is the key to the problems that occurred here, and that is a leadership issue. To be able to make decisions that best meet the overall vision and goals, teachers, staff, and administrators not only have to be aware of those, but they have to be able to act on them— or at least make recommendations— as well. Had that been the case at Bergenia, the lab monitors may perhaps have felt both the responsibility and the authority to bring up an issue that teachers and students had expressed to them.

Such communication among all constituents facilitates other aspects of technology planning as well. For example, teachers at several schools complained about higher-level decisions that brought technologies that they did not really use to their rooms, or pulled cables to inaccessible or unusable locations in their classroom. To be effective, therefore, leadership and planning has to take place at multiple, interconnected levels simultaneously. Without such an approach, equipment and infrastructure is not necessarily deployed in a manner that affords the most effective usage.

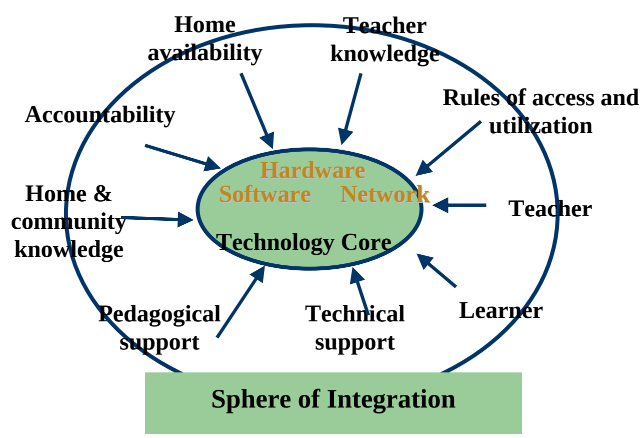
Conclusions and Recommendations

With $1 billion already invested in the process through the DHS program, the state of California has an intrinsic interest in finding ways to reduce barriers and accelerate the integration of new technologies into school settings. No single variable alone can provide all the necessary remedies for the integration process. It takes a systemic effort of many of these variables to make the changes necessary to facilitate the effective integration of new technologies into schools. Findings from this study point to several recommendations for the next wave of technology integration efforts. These recommendations include:

1. New technologies need to be made not just available, but also accessible for a wide range of student use. If students indeed learn more on their own than from school sources, as the data in this study indicates, school student use policies need to provide students the opportunity to explore areas of their own interest, opening opportunities for learning, even if not directly related to their academic assignments. Furthermore, schools and teachers need to hold higher expectations of student technology access and use. By withholding technology-involved assignments, teachers may be actually further disadvantaging students in terms of developing their new technologies understandings and skills.
2. Schools need to build upon a robust hardware and network infrastructure on-campus technical expertise and support, a cadre of technology-savvy teacher mentors, and administrative support that includes effective modes of communication among these parties. When one of these elements is weak or missing, the integration process appears to suffer significantly.
3. Schools, districts and teacher education programs need to continue efforts to build networks of professional development support, particularly for novice teachers. A common characteristic of effective technology-using teachers is their involvement in professional networks of support both within and outside of their schools. Schools can build this capacity of involvement by establishing cadres of teacher technology mentors who can provide focused, as-needed assistance to their peers. Teacher education programs can introduce pre- and in-service teachers to larger networks of professional practice that can provide model lessons, discussions, and collegial connections. These resources are proven means to help teachers establish those relationships that will aid them in sorting through and making meaning of the plethora of information they will encounter as new and developing teachers.
4. School leaderships need to establish shared technology visions that include a focus on technology-infused content learning, and communicate among both teachers and students. Most importantly, though, this vision must involve a focus on content learning in which technology is infused as part of the learning process, rather than, as at some of the schools in the study, oriented to technology as the product of the learning experience (Meskill et al., 2002).
5. Both class schedules and physical plans of schools need to be reconsidered. Block schedules provide time necessary for the student-centered, hands-on time that technology brings to the learning experience. Well-planned physical layout of schools contributes to teacher collaboration and professional growth.

These recommendations can be distilled to the following: the first wave of integration focused on then technology core; the next wave of efforts must look at the myriad elements of the sphere of integration that surrounds that core (Figure 3).

Figure 3: Sphere of Integration



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Examining Instructional Design and Development of A Web-based Course: A Case Study

Bude Su

Introduction

The growth of using Web-based instruction in higher education has been remarkable. Between fall 1995 and 1997-1998, the percentage of higher education institutions offering distance education courses in the United States increased from 33 percent to 44 percent. The percentage of institutions using asynchronous Internet-based technologies nearly tripled, from 22 percent of institutions in 1995 to 60 percent of institutions in 1997-1998 (National Center for Education Statistics [NCES], 1998). More and more distance students are taking Web-based courses instead of learning through live audio or television. 68% of the master's students who participated in distance education classes used the World Wide Web while 45% and 29% of the master's student used live or prerecorded audio or television (NCES, 2002).

Although the Web-based education is growing fast, educators are not necessarily ready to teach online courses. Instructors in higher education are often asked by the institutions to build online courses or to adapt some of their face-to-face courses to be delivered online. But are they ready to offer Web-based courses? Do they have enough references to refer to? According to National Center for Education Statistics report (2001), one of the greatest difficulties to teaching online was the lack of guidance on how to teach with technologies in their own situations. It seems clear to us that the instructional design field needs to have new and revised methods of instruction in order to take full advantage of the World Wide Web in education. In this study, through examining the instructional design process of a graduate level Web-based course, the researcher hopes to provide useful references for educators who may need to conduct a similar Web-based course in the near future.

Research questions

1. How did the instructors and course designers build the Web-based course?
2. What major changes were made during course adaptation? And why?
3. What are the students' reactions to the course features?

Conceptualization and literature review

Instructional design is also known as instructional systems design (ISD). It is a systematic development of instruction using teaching and learning theories to ensure the quality of instruction. The instructional design process is concerned with "what process[es] a teacher or instructional designer should use to plan and prepare for the instruction" (Reigeluth, 1999). It is the process of combining analysis of learning needs and objectives with the design and development of a delivery system to meet those needs; it contains development of instructional materials and activities, and tests and evaluates all instruction and learner activities.

Designing any type of instruction involves identifying the overall instructional goal and the corresponding theoretical and pedagogical strategies that will help accomplish that goal. When people are faced with developing an online course that needs to be delivered through a relatively new medium, such as World Wide Web, they tend to concentrate on the technological issues such as the capabilities of the medium instead of focusing on the instructional objectives, learner needs, and the specific task designs etc. (Rieber, 1994; Bannan & Milheim, 1997). Littlejohn (2002) pointed out that there are several critical issues in instructional design in Web-based Higher Education that should be addressed to match the rapid shift towards online learning.

> *Should be "Focusing on course outcomes rather than content":* Heavy content based course design without considering the possible learning outcomes may result in unengaging learning experience-- "leading to surface learning". For this reason, educators should focus on the achievement of learning outcomes when developing online courses.
>
> *Should be "Placing dialogue and feedback central to course design":* Merely assigning a task to students is not enough for quality learning. Providing communication and collaboration is a critical part of online learning and thus the course design should consider offering opportunities for dialogue and feedback for students.

Should be "Incorporating current educational theory": Educational theories can provide valuable recommendations and justifications for the instructional design activities and thus can help educators to set and evaluate appropriate tasks and activities for students.

Should be "Deciding on the message before choosing the medium": A common mistake nowadays is that educators often emphasize on the technology issues too much while neglecting some critical course design issues. Therefore, it is important to design the course related activities first and then consider what technology may better assist those activities.

Some of the above mentioned instructional course design issues are not entirely new since they also exist in the traditional course design process. However, as Littlejohn emphasized, these issues seem especially prevalent in current online course design processes. For instance, because of the lack of technological skills in the online course delivery environment, the faculty often relies on staff members to design the Web pages and to develop the major portion of the online courses. As a result the technological issues are usually well addressed while the actual pedagogical issues are often neglected. This point is also well illustrated by Hara & Kling (1999): "There has been an unrelenting cycle of technology promotion and adoption in classrooms since the 1920s, where technology was introduced by enthusiastic advocates, such as administrators and researchers, only to fail because teacher lacked equipment, time and training."

It has becomes common knowledge that World Wide Web can be a powerful medium for teaching and learning at a distance. According to Khan (2001), "Numerous factors help to create a meaningful learning environment, and many of these factors are systemically interrelated and interdependent." He developed a Web-based Learning Framework that categorizes these factors into eight dimensions: pedagogical, technological, interface design, evaluation, management, resource support, and institutional.

While Khan's holistic Framework provides the scaffolding for designing quality Web-based instruction, it seems too broad to provide practical guidelines on design details. There is no doubt that such a comprehensive theoretical framework is absolutely useful as a reference for designing an effective online course; however, it is not sufficient. Other practical considerations such as when faculty should start the preparation, what process they should follow, what external aids they may need, and what impact a certain design may have on students etc. are also critical for designing and developing an online course. University of Illinois Faculty Seminar Report (1999) summarized two sets of guidelines for designing and developing online coursework. The questions asked in the first set of the guidelines, *practical considerations for faculty*, can provide additional insights to capture the critical issues in the online course design from the faculty perspective. They are:

Whom do I teach?
It is critical to do learner analysis before building an online course. Not everyone is suitable to take online courses and not all programs can be delivered through the Internet.

How do I teach?
Choosing the right methods and media in relation to the nature of the course is critical. For instance, text-based CMC seems more appropriate for seminars while interactive and graphically based materials are better suited for courses that are traditionally taught in the lecture mode etc.

How many do I teach?
Keeping student-to-teacher ratio low is important to maintain a highly engaged online class. The importance of motivation and the learning community is also addressed in this section.

How do I ensure high quality of online teaching?
"Online course quality is best assured when ownership of developed materials remains in the hands of faculty members" rather than in the control of non-teacher course designers or administrators. Evaluation of learning effectiveness is also a critical aspect to ensure the course quality.

Unfortunately, there are not many empirical studies that showed how educators were building online courses or how they were adapting the residential courses to the online environment. One possible reason may be due to the fact that every course is unique in terms of the course objectives, content, students, and resources. The uniqueness of each case may result in different instructional design processes and thus hinder the transferability of a case to other situations. However, as Dick & Reiser (1989) pointed out, instruction (sequences) generally have seven common elements: "motivating the learner, specifying what is to be learned, prompting the learner to recall and apply previous knowledge, providing new information, offering guidance and feedback, testing comprehension, and supplying enrichment or remediation". Since these common considerations exist in all types of instruction, educators can still learn a lot by just reading others' experiences. A close examination of a practical case can provide valuable experience to the readers who may learn and adapt certain design strategies in to their own situations.

Case selection and Course description

The selected case is a computer mediated learning course (R547). The researcher is one of the teaching assistants (TAs) of this Web-based distance course and had experience assisting with the residential version of the same course in the past. R547 is a three-credit master's level course on design, development and formative evaluation of computer-mediated learning programs. Students use software development tools to create and evaluate interactive lessons (detailed information can be found at: `http://www.indiana.edu/~r547/`)

It is an intermediate level design and development course and thus the students enrolled in this class are fairly familiar with software and hardware applications from their previous class experiences. The faculty members who teach R547 have strong technological backgrounds. The traditional version of R547 has been taught for many years and it is still offered once a year to the residential students. It is important to note that the primary instructor of the online R547 did not have previous experience with teaching R547 although she took this course as a student several years ago.

Fourteen students enrolled in the current online R547. All of them have full time jobs and most of them have families. Four students work for higher educational institutions, three students work in corporate settings, and seven students are K-12 teachers.

Methodology

Data collection methods

According to Yin (1994), case study is an appropriate strategy when the nature of the research questions aims to discover "how" and "why" of certain phenomenon within real life context. The current study posed how and why the instructors and course designers are planning, designing, developing, implementing, managing, and evaluating their online course. It also provides how students feel about the major features of this Web-based course. The specific methods of collecting data are listed below:

Instructor interviews A total number of seven people were interviewed including the primary instructors of both online and traditional versions of the R547, teaching assistants, technical coordinator, and institutional supporter. A 30 – 80 minutes, one-on-one interview was conducted with each of the participants. Each interview was audiotaped and partially transcribed. The interview questions were designed to capture the essential activities and decision-making points of course design and development process and also addressed other related questions. The interview questions can be categorized into a few major categories (for detailed questions, please see Appendix I, II, and III):

Related background information of participants: This piece of information helps understand what kinds of knowledge and skills are involved in this online course design and development.

What: What are the objectives, scope, resources, content and structures of the course? What activities and events did they conduct to accomplish what goals? Are they still making certain changes and adjustments to the course? What external help did they have?

How: How did they start the design process? How did they decide on the delivery methods and media? How will student performance and achievement be measured?

When: When did they start to prepare for the online course? How long did each critical step take? Was more time needed?

Why: To find out the rationales behind major decision-making points that took place during the online design and development process. How did the online course differ from the traditional version of the course? Why were certain changes made?

Document analysis Course syllabus, schedule, weekly readings and assignments, messages posted in the discussion forums, completed projects and reports are reviewed and analyzed various stages to provide additional information for a holistic understanding of the case.

Participant observation As one of the teaching assistants in both the online and traditional versions of this course, the researcher herself participated and observed the detailed design, development, and evaluation process of the instruction. Hopefully, such an experience can deepen the understanding of each phase of the development in great detail.

Student survey on course evaluation A mid-term course evaluation of 44 items was sent to the students after the first 8 weeks' class. This anonymous survey was active for three weeks and received 100 percent return rate. Among the 44 survey questions, the first 37 questions were 5-Likert Scale items (1= strongly disagree and 5= strongly agree) and the rest are open-ended questions. I am going to use some of the survey data to analyze what impact certain instructional design strategies have on students.

Data analysis methods

There are numerous instructional design models in the field of education. But almost all of the ISD models are based on the traditional generic ADDIE model (Kruse, 2002; Molenda, 2003). Although the ADDIE model has been criticized as too linear, inflexible, and time consuming, it is a systematic approach of designing instruction and thus provides a holistic perspective on the design and development process. Furthermore, the preparation stage of most Web-based courses, if not all, takes a fairly long time, at least a couple months before the courses are taught.

The word ADDIE represents each phase of the instructional design process: Analysis, Design, Development, Implementation, and Evaluation. Villalba and Romiszowski (2001) pointed out another category, Management. Issues of management seem especially critical in an online course environment due to its heavy technology-dependent nature. A good management strategy can ensure maintenance of high quality program throughout the entire teaching and learning process. Therefore, the course design and development actions are classified into the above six categories of an elaborated ADDIE model. A comprehensive summary of major changes of the course adaptation is provided in the Results section. The major changes and timetables went through the member checking process.

The relevant student survey data were identified from the whole data set first. Next, the mean scores of the 5-Likert scale items were calculated for each question. And then the findings were matched to the relevant design strategies to reflect the student reactions to major course features. A summary of the reactions and the implications is provided in a table.

Results

The collected data were analyzed in the following six categories of the elaborated ADDIE model: analysis, design, development, implementation, evaluation, and management.

Analysis

Early preparation: Four months before the online R547 was offered, the instructor of the course asked to be a volunteer TA of the residential version of R547 to gain necessary teaching experience and also to get more familiar with the course content. At the same time she started to look for appropriate readings for her distance students. She thought that representative and high quality required readings are necessary for distance students since they will not have face-to-face lectures from the professor as the residential students have.

Student survey of technology access: About three months before the online class started, the department sent out a survey to verify what computer platforms (PC or MAC) and network connections the registered students had. Although not everyone was registered for the class at that time, they had a representative sample of the entire class. (2/3 of the class was registered at that time). Based on this student survey, the instructor contacted the University Information Technology Service (UITS) to find out what new technologies can be employed to enhance the communication of the class. She had five different meetings with the director and staff of UITS to discuss two issues. One is how to conduct Web conferencing with students in a real time (synchronous communication), and the other one is how to make class tutorial using screen and voice capture.

Finding available support: The primary instructor of R547 sent out an announcement to find those who are interested in being volunteer teaching assistants (TAs) in the department. Six advanced graduate students were interviewed and accepted as teaching assistants. The department also asked another advanced doctoral student to be the technical coordinator of this course. Thus a team of eight people formed to teach this online cohort of 14 students. Based on everyone' preference and skill set, the following roles were given to six volunteer TAs:

Four frontline TAs: each will be in contact with 3-4 students on a regular basis to provide immediate feedback and help

One pedagogical assistant and editor: since most of the TAs are international students, an English editor is needed.

Technological TA: part of the course content requires students to have certain level of programming skills and a TA who knows programming is needed.

Student background information analysis: Students were asked to complete a pre-assessment survey on the first day of the class. This survey is designed to determine student background information such as where they are in their program, how many other courses they are taking at the same time, where they work and what their career goals are etc. During the first week of the class, the instructor conducted an hour long one-on-one voice chat with each student using either Netmeeting or Yahoo Messenger. The purpose of this synchronous communication was to know each of her students better and also to inform students that the class had officially began. Based on the pre-assessment survey and the one-on-one voice chat, the instructor divided the class into four different peer support groups. A corporate group, a higher education group, and two K-12 groups were formed. Each group has a primary TA assigned to them from the volunteer TAs.

Design and development

The design and development process of this course went hand in hand and it was almost impossible to separate each development activity from its design stage. Therefore, they are described together in this section. About two months before the class started, the instructor and the technical facilitator started the course design and development process. All the resources that were used in the residential R547 were copied from SiteScape Forum to the Oncourse course management system. Some of the materials were converted into Web pages in order to have a link provided. The residential version of the R547 syllabus and teaching strategies were modified in a few ways to accommodate the online nature.

Changed the team-based project to an individual project: This modification is made to eliminate the possible frustration of teamwork at a distance. Students may save lots of time if there are less management issues. Furthermore, choosing a project in their primary interest may result in more engagement and motivation.

Discussion forum: A weekly discussion topic is led by TAs based on each week' readings. Each discussion topic is pre-designed and developed by 1-2 TAs first. Furthermore, the instructor and the pedagogical TA will further revise and polish the discussion topics before they are available for students. All students are required to participate in the weekly discussion forum since it is designed to partially substitute for the face-to-face version of lectures.

Syllabus: Hardware and software requirements were added to the syllabus. Assignment and activities were modified to reflect the weekly schedule of the online course. Assessment criteria are somewhat different from the residential version. Since the project is changed from team-based to individual, there won't be a peer evaluation component. Instead the discussion forum participation will be considered in the final achievement evaluation.

Tutorial design: As students are required to build an online resume and a Web-based instructional project, they need to have individual server space where they can upload their Homepage and Web product. About six weeks before the class started the technical facilitator applied for server accounts for students, and created a step-by-step online job aid for the student's use. The programming language portion of the course in the residential version needs two weeks (four sessions) to deliver face-to-face. The programming TA worked with the University Information Technology Center to develop a lecture CD in which the demonstration on computer screen and the voice are captured. Each student received a copy of the CD.

Weekly instructor and TA meeting: Five weeks prior to the beginning of class, the first TA meeting (primary instructor and TAs) was held to determine the action agenda for designing and developing overall content focus as well as the content of weekly sessions.

- What the general course structure would be
- What media might be used
- What the online discussion topics should cover
- What the discussion topic order should be
- Who should lead which topics
- What the class schedules (reading & assignment due date) should be
- What the evaluation criteria would be

Discussion topic design: Each TA is responsible for leading 1-2 discussion topics throughout the semester. Who should facilitate what topic was determined based on TAs' preferences, background knowledge, research directions and proficiency level. TAs are asked to send a draft of topic outline two weeks prior to the discussion week. The primary instructor and the pedagogical TA are responsible for checking whether the designed activities in each topic are appropriate and engaging. Since the online discussion topics are a part of the substitute for the face-to-face lecture, it is critical to prepare each topic carefully. This part of the content design and development continued through two-third of the semester. Therefore, the design and development of course content were not completely ready before the semester started.

Another part of the substitutes for face-to-face lecture is synchronous live lectures that are given by four guest speakers during the second half of the semester. The primary instructor believes that synchronous discussion and live lecture can be a valuable learning experience for distance students once the technical issues are overcome.

Implementation

The implementation phase was started once the first course segment, the modified syllabus, was uploaded and tested on the course management system. The technical coordinator needed to convert various documents such as the syllabus, schedules, discussion topic outlines, and some other course materials into HTML Web pages. During the couple months before the class started, the technical coordinator spent about twenty hours a week on converting documents into Web pages, testing their usability, copying/moving certain course materials from the residential course site and setting up various work folders for students and TAs on the course management system. Once the class started, the technical coordinator mainly needed to maintain the course management system and it did not take too much time.

After the class started, TAs were asked to contact each of their students for a one-on-one or as a small group voice chat. This was to help student prepare for the synchronous meeting and lectures in the near future. If they learnt to use the Web conferencing tools beforehand, it could make their learning easier later in the semester.

Evaluation

During the content development, various documents went through recursive evaluation process. The technical coordinator would first develop the Web pages and the primary instructor would evaluate the quality of the work. If they were not satisfactory, further revision would be needed. According the technical coordinator, the re-designing and re-doing took much more time than she had expected.

Each online discussion forum outline was developed by TAs who were responsible for that topic. If the primary instructor and pedagogical TA felt it needed revision and re-design, they would have a small group meeting with the initial designers to revise the topic outline until it reached a satisfactory stage.

A mid-term course evaluation survey was sent out to each student for determining the potential enhancements for the overall course design, development, and evaluation. Plenty of positive feedback was received from students.

Management

In order to maintain a well working online course, the following strategies are employed:

- Weekly announcement on Oncourse to inform student what the focus of the week is and what the deliverables are
- Weekly TA meeting to discuss what is happening with each group and what actions should be taken next etc.
- TAs are required to check their Oncourse email once a day
- TAs are asked to respond to student questions in 24 hours
- TAs are required to give out prompt and extensive feedback on student work
- TAs also need to contact student at least once a week either one-on-one or as a small group

Major changes made during course adaptation:

Residential R547	Online R547	Justifications
Team-based project	Individual project	To eliminate teamwork frustration at distance To increase engagement and motivation
Lecture (twice a week)	Facilitated discussion forum (weekly)	Using structured weekly discussions to partially substitute for the lectures. The purpose was to promote deeper thinking and engagement about key concepts that related to their development work.
Less readings (no required textbooks; supplemental online sources provided)	More readings (Structured weekly readings based on two required textbooks and supplemental online sources)	This was designed to provide more structure for students, as a substitute for absence of face-to-face lectures.

Hands on demonstrations	Job aids and CD tutorials	Since the hands on demonstration were not possible at distance, online job aids and CDs were produced.
Use of course management system: Reference resources Team working space Gradebook	Use of course management system: Reference resources Team working space Gradebook Email communications Class discussion forums Announcements Calendar with task items Online surveys	The use of various communication modes and weekly announcement of assignments and deliverables seemed critical in online R547 since the instructor can not share information and remind students in person
Face to face consultation and problem solving	Synchronous (voice/text chat) and asynchronous (email/discussion board) communications	Based on the group members' computer platforms and broadband connections, different software was used to exchange ideas and to solve problems. Students were required to learn a simple voice chat software (i.e. Yahoo Messenger, Ivisit), a web-conferencing software (Groove, Netmeeting), and course management systems (Oncourse and SSF). The underlying assumption was that the context of different problems and users required different methods of communication. Voice chat was used as a redundant, backup system in case firewalls and/or connection speeds prevented the use of web conferencing software.
No assigned TAs for each student	Each student has a primary TA to contact	To provide quality technical support with one-on-one tutorial support To provide rapid turnaround of the feedback To eliminate student feeling of isolation
Student to TA ratio is 8:1	Student to TA ratio is 3:1	It was believed that lower student to TA ratio can help provide quality and prompt feedback for students
No regular instructor & TA meeting	Weekly TA meeting	To keep track of what is happening To provide consistent feedback to students To implement consistent action plans
No assigned peer support groups	Assigned peer support groups of 3-4 students based on their work background	To reduce feeling of isolation To provide peer perspectives and support It was believed that people with similar experience tended to provide more relevant feedback to each other
Peer evaluation is 10% of total grade	Class forum participation is 10% of total grade; Written peer support group feedback is 10% of total grade	Since the project work is individual-based, there is no need for peer evaluation on project development process. Instead, the discussion forum participation and peer communications are more critical for online courses

Students' reactions to the course features

This section of the report is based on the mid-term course evaluation. Overall, the feedback was very positive. Important findings that are associated with the changes made during course adaptation are analyzed below:

Reactions to individual based projects: In the course evaluation, thirteen out of fourteen students think having the class projects as individual-based projects enhances their learning experience (M= 4.29, out of 5-Likert scale). One student wrote, "It has been very motivating to me and I recommend that you continue to have the flexibility to allow students to do projects that are meaningful to them." Another student expressed a similar opinion

"I appreciate that I'm designing things that I can actually use." On the other hand, another student wrote, "I'm intimidated by the prospect of putting this all together myself on Dreamweaver… I need a technical advisor…" This made us question whether this modification was a total success. In general the team-based projects are to promote collaborative learning. It is believed that team members' complimentary skills are necessary to accomplish the task successfully and that they can learn from each other by working together. When the course projects were assigned as individual tasks, instructors need to consider what other relevant changes should be made to align with that modification? Is it fair to assign the same workload for one student while three to four students used to work on one project in the face-to-face version of this course? While we try to keep a high quality online course in which we make distance students learn no less than what residential students learn on site, we are lack of experience how to balance student workload with various changed strategies we made in distance education.

Discussion forum: Eleven out of fourteen students agree the online forum discussions promote their understanding of the concepts in this course (M= 3.7). In order to enhance the participation rate and engagement, the weekly discussions had various role assignments for each student either in their peer support group or in the entire class. However, students seem less happy with such structured discussions (M= 3.07). The open-ended questions revealed students' unenthusiastic attitudes toward the structured weekly discussions such as "Don't ask people to be wrappers – it is way too much work. Just allow us to freely discuss a topic", "It would have been useful for the instructor to provide some type of summary of the topic – to capture key thoughts", and "Some of the weekly discussions are a little too much with the other work we have." These comments emphasized the importance of pedagogical aspects of designing online discussions. While it is critical to have such a discussion forum for distance students as a partial substitute for the live lectures, it should be carefully designed and cautiously implemented in the real settings. Balancing workload and providing key takeaways of the discussion topics may enhance the effectiveness and student satisfaction of discussion forum usage.

Communication mode: Upon being asked to rate the overall value of each synchronous and asynchronous communication tools, students voted email of great value over other media.

E-mail: M=4.71
Asynchronous discussion forum: M=4.43
Synchronous voice chat: M=3.93
Synchronous text chat: M=3.86
Enhanced voice chat with co-browsing and co-viewing of documents M=3.57

These data showed that students prefer to communicate asynchronously than to communicate synchronously. Students were introduced to several different synchronous and asynchronous software applications such as Yahoo Messenger, Ivisit, Groove, Netmeeting, Oncourse, and SSF. The purpose was to accommodate students with different network connections (broadband vs. dial up) and computer platforms and to provide flexible communications. However, students expressed frustrations over learning to use so many different applications: "We seem to be experimenting with a lot of different tools and modes. It feels a bit disintegrated to use Oncourse, SSF, Groove, Netmeeting, etc. For future reference I would narrow it down to fewer communication tools, fewer new software products to learn"

> "Too many options make for some confusion. Find something that works and stick with it…"

> "At times, we seem to want to use online technology when a simple telephone call would do."

> "The interactive tools proved to be a frustrating experience. We all seemed to have some problems with them. In theory, tools such as Groove and Netmeeting are wonderful. In application, it may be a different matter…"

One suggestion of these survey data is to minimize the types of software applications for student use. While synchronous and asynchronous communications both have their own value, it is important to balance their proportions in distance education.

Reactions to TAs and the instructor: All students agree that TAs have provided quality, supportive feedback to them (M= 4.57). Student gave a very high remark to the voluntary TAs. The open-ended feedbacks of "I am totally impressed with the dedication of the TA's and the instructor to helping the class" and "It was nice to see the T.A. paying attention to the support group and checking in with folks" help illustrate students' positive attitude toward TAs. However, students may not want TAs to be involved in every aspects of the course. One student wrote as:

> "Although synchronous chats for the entire class tend to be inefficient and chaotic, because they end up being multithreaded, I think they are helpful to provide an ongoing focus to the class. These should be conducted by the instructor, with little or no participation by TAs".

Although students appreciate the help from TAs, they tend to prefer direct support from the instructor at certain times, if not always. These empirical data poked a few questions for future research: what should the TA's role be in distance education and how much should a TA be involved? Another relevant question is what the best (cost-effective) student to TA ratio is?

Peer support: Based on the students' work sector, preference, and relevant experience, the instructor assigned each student to a peer support group of 3-4 people at the beginning of the semester. The purpose was to eliminate the student's feelings of isolation and to provide peer perspectives and support. All students admit that peers in their peer support group have been supportive (M= 4.5). "I've really enjoyed the group and class discussion forums. It's helpful to get input from my cohort peers", "working with my peer group on projects [is the favorite aspect of the course]", "The peer support groups have been more valuable than the larger group discussions. I appreciate the perspective of the corporate and higher education groups, but my goals focus primarily on the K-12 arena" and "my least favorite are the discussions with the entire class. I don't feel the feedback and time spent is helping me like the smaller group discussions have." However, not all students like to be assigned into such a background-based peer support group. One student wrote,

> "I don't like the segregation of K-12, higher ed, and corporate. While it is nice to have a peer group occasionally, I really miss the interaction with others and the valuable ideas and help I gain from the class as a whole. This format seems to be very limiting and I know I haven't learned as much as I would have if I interacted with others in the class as well as those in my peer group."

There is no doubt that peers can provide valuable support and insight for each other. But the critical issues seem two fold: what are the best ways to assign peer support groups and how to balance small group and the entire class interactions. The individual differences seem to be at play as well. There may not be an easy solution to satisfy everyone's need and expectation on this issue, but future studies should be dedicated to finding better ways to accommodate the students' preferences.

Appendix I

Student survey data analysis

Major modification	Student feedback	Implications
Individual-based project	Advantages: -Provides flexibility over project selection -Promote motivation and engagement -Eliminate the teamwork frustration at distance Disadvantages: -Increase student workload -Increase frustration on some students who do not have all the skills required for finishing the project successfully	Need to consider what other relevant changes should be made to align with this modification
Structured (role assigned) online discussion	Advantages: -Promote deeper thinking and engagement about key concepts Disadvantages: -Inflexibility -Too much work while there are other assignments due at the same week -Student easily get lost and do not know what the key points are	Provide key takeaways of the discussion topic and balance workload
Synchronous and asynchronous communications	Student preference: -Email -Asynchronous discussion forum -Synchronous voice chat -Synchronous text chat -Enhanced voice chat with co-browsing and co-viewing of documents Students frustrated to learn too many communication tools including Yahoo Messenger, Ivisit, Groove, Netmeeting, Oncourse, and SSF	Minimize the number of communication software Balance the proportion of synchronous and asynchronous communication
Low student to TA ratio	Advantages: -Provide prompt and helpful feedback on student work and questions -Eliminate the feeling of isolation Student concern: -TAs are doing some jobs that should be done by the primary instructor	What should TA's role be in distance education? What is the best (cost-effective) student to TA ration?
Assigned peer support groups based on students' work sector, preference, and work experience	Advantages: -Provide most relevant feedback -Promote deeper discussion on the focused topic Disadvantages: -Decrease the chance of getting feedback from others who are from different background and thus limit the possibility to provide diverse perspectives	What are the best way to assign peer support groups? How to balance small group and the entire class interaction?

Conclusion

In this case study of examining instructional design and development of a Web-based course, the interview data were analyzed using the elaborated ADDIE model. The major changes made during course adaptation from traditional version to online version were highlighted. And the consequences of major changes on students were analyzed from the student feedback received during the mid-term course evaluation. Useful implications and possible research questions for future research studies were drawn from the analysis done in the results section.

The major limitation of this study resides in the fact that this is a single case study with 14 students. It is also important to note that this course is offered by Instructional Technology department. This means the instructor and TAs are experts in instructional design and development. Therefore, the current case is an atypical in this sense. Since each course is unique in many ways, the result of this study should be referenced cautiously upon implementation in different situations. Similar case studies should be conducted in the future to provide more powerful results for educator use.

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Informing Instructional Systems: The Concept of Intention in the Context of Learning and Instructional Theories

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Abstract

This presentation paper discusses the concept of intention in the context of learning and instructional theories that inform the field of instructional systems and human performance, e.g. behaviorism, information processing, and motivation. The closing section speculates benefits to the field of instructional design from incorporating intention research. The conclusion advocates the use of the intention conception with the Instructional Systems applied research activities to build a model for complex affective skill acquisition.

Introduction

Ruth Kanfer of the University of Wisconsin has provided statements regarding current research efforts, and asserts that they all relate to motivation: assessment of intrinsic outcomes, information processing, changes in motivational orientation, and developing cross-disciplinary models of motivation. "Contemporary findings indicate that differential activation of particular motive states depends on the individuals' previous history and environmental factors….Unlike earlier theory, the emphasis in current research is one of the factors that influence the way information is processed, that is, changes in motivational orientation rather than on the influence of specific motives per se. Focusing on these facilitates opportunities for developing more comprehensive, cross-disciplinary models of motivation" (Kanfer, 1990).

In essence, the described line of research is of professional interest and personally valued as relevant to the instructional systems research and practitioner communities. The expressed research interests encompass affect and how it moderates (positive and negative) information processing in learning, behavior, and performance. The interest in intention research is an attempt to understand human learning, behavior, and performance, explain the variance, and then recommend how to effect change. Related research interests include: affect, valuing, cognition, volition/cognitive choice, decision-making, and metacognition. From cursory readings it was observed that the intention construct is related to all of the referenced research areas and supports the processes of goal setting and self-regulation. "The constructs of motivation subsume the determinants and processes underlying the development of intentions, choice behaviors, and volitional activities. The products of these motivational processes are the individual's overt and/or covert behaviors" (Kanfer, 1990). A second observation is that the majority of the research interests share conceptual origins with research in motivation.

The Intention Construct and Theory of Planned Behavior

According to Icek Ajzen and Martin Fishbein, intention captures the motivational factors that impact behavior. They are indications of how hard people are willing to try, and how much of an effort they are planning to exert, in order to perform that behavior. "These intentions remain as behavioral dispositions until at the appropriate time and opportunity an attempt is made to translate the intention into action" (Ajzen, 1988).

Intention predicts behavior.

Available evidence supports the idea that intentions are close antecedents of overt actions. The predictive validity of intention is usually significantly greater than that of attitudes toward the behavior (Manstead, 1983). Intention has been found to predict a variety of corresponding action tendencies, ranging from simple strategy choices to "actions of appreciable personal or social significance, such as having an abortion, smoking marijuana, and choosing among candidates in an election" (Ajzen, 1980; Ajzen & Fishbein 1970). Although intentions can be predicted with a high degree of accuracy, they will decline with the amount of time that intervenes between measurement of intention and observation of behavior (Songer-Nocks, 1976; Fishbein & Coombs, 1974; Sejwacz et al., 1980).

According to Ajzen's theory of reasoned action, intentions are a function of two basic determinants, one personal in nature and the other reflecting social influence (the person's attitude toward the behavior). This attitude is the individual's positive or negative evaluation of performing the particular behavior of interest. The second determinant of intention is the person's perception of social pressure to perform or not to perform the behavior under consideration (subjective norm).

The theory of planned behavior is considered an extension of the theory of reasoned action. The theory of planned behavior (TPB) adds a third determinant of intention - perceived behavioral control (Ajzen, 1985; Ajzen & Madden, 1986). The TPB incorporates perceived behavioral control as a factor inhibiting or encouraging one's intentions towards behavior. Study data indicates that perception of behavioral control can have an important impact on a person's behavioral motivation (Ajzen, 1988; Ajzen and Madden, 1986; Schifter & Ajzen, 1985).

Generally speaking, people intend to perform a behavior if their personal evaluations of it are favorable, if they think that important others would approve of it, and if they believe that the requisite resources and opportunities will be available. Subjective evaluation of those outcomes, reveal why a person holds a favorable or unfavorable attitude toward performing the behavior. Taken together, this informational base provides us with a detailed explanation of a person's tendency to perform, or not to perform, a particular behavior (Ajzen, 1988).

Relevancy of intention research to learning and instructional systems theories

"Expectancy-value theories, intrinsic motivation theories, self-regulation theories, and attributional theories all have stressed the energizing role of affect and emotion as they influence the individual's organization and interpretation of knowledge and search for information" (Kanfer, 1990).

It is speculated that training situations which require affective and behavioral change to obtain performance will benefit the most directly and immediately from intention research results. Additional plausible benefits from intention research results within learning and instructional systems are:

- development of learning conditions for affective domain skills,
- design, development, and implementation of methods, strategies, and tools for affective domain training,
- affect related information processing adjustment to other cognitive-behavioral change interventions, and
- inform current performance improvement strategies of additional techniques.

The intention research is compatible with other motivation theories, such as Keller's ARCS motivation theory, McClelland's need for achievement theory, Atkinson's anxiety and learning, and learning theories such as Behaviorism and social learning theory (Driscoll, 2000). Keller's ARCS model (1987) has provided principles to gain attention and build relevance, confidence, and satisfaction within instructional materials. The model is effective to move an individual through the instructional material while maintaining interest. It is believed that intention research results will support the principles of motivational design (of instructional materials) by providing specific ratio, emphasis, order, or repetition required for predominantly affective skill acquisition. Also, the intention research tools could be supportive in diagnosing why a learner does not engage with motivationally designed instructional materials. Consider this analogy, "You can bring a horse to water, but how do you get him to drink it?" How does one engage the horse in voluntary drinking of water without the internal drive of thirst to stimulate the desire for water? Likewise it is assumed that the water is well-designed instruction with plenty of motivational characteristics to maintain interest after drinking begins. The analogy is used only to illustrate perceived current limits of learning and instructional theories.

Behaviorist strategies like Hull's drives toward anticipated goals (Driscoll, 2000) are effective after behavior is engaged (directly or indirectly valued) and rewarded. For example, a behavioral approach to increasing duration and frequency of study behavior must make a pay off with rewards that can compete with other rewards gained from competing behaviors (social, recreation, work, sleeping). The solution is simple – provide for multiple short-term payoffs (Wager, 1977). What is an effective intervention when a behavioral outcome is not valued, perceived as controllable, or the performance to reach that goal carries too many negative consequences? Can a goal be set for something that is perceived as irrelevant, having negative social consequences, and creating negative behavioral outcomes? The researcher's objective is to use the intention construct to study this type of problem in human learning (behavior acquisition) and performance. It is believed that part of the answer is associated with intention antecedents (behavior evaluation, subjective norms, and perceived behavior control).

It is plausible to describe the antecedents of intention (positive or negative evaluation of performing the particular behavior, and subjective norms) as further elaborations of Ebbinghaus and Thorndikes' theories of association, and later behaviorists' theories of counter-conditioning (systematic desensitization). Results from intention research can inform how to better organize learning events (instruction) to counter negative affect, negative associations, negative conditioning and to allow more positive information processing to occur without dissonance. For example, some populations of learners (young and old) continue to believe and state, "I can't learn ___," "I can't do ___," "I could never learn/do ___." It's conceivable that an effective intervention would include desensitization of prior negative associations and conditioned responses. Eventually, the goal is to create an algorithm to determine countering per antecedent or desensitization per antecedent. For instance, to advance an individual to behavior acquisition, how much emphasis should be placed on perceived behavioral control in relation to his negative evaluation of the behavioral outcome?

McClelland's theory of need for achievement does not seem to address voluntary behavior acquisition and performance in the realm of non-consequence and negative associations. However, Atkinson's anxiety and performance theory may be complimentary to interventions related to the perception of behavioral control. Bandura's social learning theory has similar tenets as the theory of planned behavior, e.g. Bandura's self-efficacy as a belief system that is causally related to behavior and outcomes (Driscoll, 2000). It appears that perceived behavior control and self-efficacy are related to Bandura's self-efficacy belief system. The theories of how it mediates performance are the most comparable of all the theories I have reviewed within learning and instructional systems. And finally, Locke, Latham and Zimmerman's theories of goal setting and self-regulation (Driscoll, 2000) are critical but begin after behavior intention is present. It is my opinion that proximal goals of XY behavior outcome or performance would be the most immediately relevant to populations experiencing negative affect towards XY behavior or performance.

A plausible use of intention research is to inform or explain variance of performance especially when the instructional materials were designed with sound design principles. As Kanfer states, cross-disciplinary and comprehensive models better explain human behavior and its variances. Perhaps a comprehensive motivation model would provide greater understanding of how to engage negative affect, build intrinsic value for a particular behavior, address variations of subjective norms, and increase perception of behavior control.

Several societal, organizational, and personal problems have a solution available but it is dependent upon an individual's choice to change behavior; the individual must choose to do "other." Ajzen and Fishbein et al., and Prochaska et al., have demonstrated that choosing to "do other" is quite complicated and certainly requires more than an informational pamphlet, campaign, or workshop. Remember, many of the choices require the extinction of habit (or norms) without direct or immediate consequences (pain/reward) to support the performance (with the exception of select safety behaviors).

Therefore, it is believed that intention research will 1) provide greater empirical basis to understand human learning, behavior, and performance, 2) inform training and tool design for difficult affective training situations, and 3) inform strategies to effectively address subjective norms and perceived behavioral control.

What is the relevancy of intention research to human performance technology?

One plausible benefit is that Instructional Systems practitioners and graduates have an applicable model when the performance context is void of appropriate reward, control, or policy systems. During academic training graduates learn to identify more factors affecting performance, and learn an intervention to increase potential for performance among low performers. Both graduates and practitioners add another valid model with solid research foundation to their professional toolbox. Cross-disciplinary knowledge broadens placement possibilities into stable, growing, and well-funded sectors of American economy. In summary, it provides another tool to affect behavioral change and performance in the absence of controls and consequences (voluntary behavior).

Adding knowledge to learning and instructional systems field

"Another contemporary trend in motivation theory is the development of theories attempting to unify prevailing motivation constructs and cognitive, information processing psychology. Researchers attempting to forge an integration of cognition and motivation have focused on meta processes such as metacognition and metamotivation – that is, the cognitive and motivational processes that presumably govern the coordination of effort and skills. Developments during the past 15 years signal the beginning of a new phase in this area. One indication of change is the increased attention given to coordination of theoretical approaches whose origins trace to different subdisciplines of psychology. For example, it is increasingly common to see studies that build on an integration of concepts from clinical self-regulation approach, behavior modification approaches, goal setting and cybernetic control theories" (Kanfer, 1990).

Is it possible to change *affect* through training design? Is it possible to increase learning efficiency, increase behavior change, and improve performance by addressing an individual's:

- positive or negative evaluation of performing the behavior(s),
- subjective norms, and
- perception of behavior control?

Some researchers have said, “Yes, it is possible to change affect.” (Ajzen, 1988; Ajzen, 1985; Manstead et al., 1983; Prochaska et al., 1994; Prochaska et al., 1994b; Prochaska, 1994c; Prochaska et al., 1993). The theory of planned behavior (and the transtheoretical model) provides results worth considering when designing an effective intervention for highly affective behaviors.

Design interventions (in the broadest sense) effect the adoption and extinction of specific behaviors born out of choice and managed by the individual. The following list is speculation of potential applications of a valid “intention” intervention:

- When aptitude is present but performance is low (high aptitude & low performance).
- Learners who present reluctance with learning tasks or whole skill sets: I can’t write, I can’t do math, I can’t spell, I don’t like to read.
- Learners deficient in complex cognitive skills for their grade level/age (e.g. reading, math, writing, science).
- Learning problems that include evaluation or “values” beyond learning verbal information, application of rules, and conceptual recognition.
- Assistance in designing interventions, treatments, programs, training, lessons, computer-based instruction, management plans, and online tools.
- Informed and more comprehensive theories, models, interventions, and techniques to be used by consultants, managers, performance technologists, change agents, preceptors, mentors, coaches, teachers, professors, parents, child care professionals and other change agents.

The following are performance problems that engage affective and cognitive learning domains. The results of intention research could be applied to the following behavioral-performance areas:

- Reading adoption (literacy, higher reading levels, read more frequently)
- Illiteracy prevention (teachers, parents, and guardians)
- Financial behavior (debt management and counseling)
- Safety behavior (worksite, travel, and home)
- Parenting skills & professional childcare providers
- Healthy Baby Healthy Mom (prenatal and 0-6 programs, Chiles Center/DCF)
- College enrollment programs for 1st generation
- College and high school drop out prevention
- Food safety behavior
- Driving safety behavior
- Health risk behavior (prevention of: disease, obesity, drug addiction, drunk driving)
- Cancer prevention (mammary, testicular, skin)
- Safe sex behavior
- Juvenile truancy behavior
- Work absenteeism and school absenteeism
- Work productivity and presenteeism
- Performance evaluation and appraisal
- Work relocation programs
- Racial integration
- Doctoral candidate drop out prevention

Conclusion

There have been sufficient studies indicating that complex skill acquisition requires sustained attention and practice, but what is still unclear is the requisite affect of the individual to engage in the task and adopt behaviors for successful performance. “Little empirical research exists on the relationship between instructional methods and activation of these different motives. Second, Lepper (1985) notes that little is known about what triggers different intrinsic motives during skill acquisition or even when motivational interventions should be implemented” (Kanfer 1990).

In summary, successful applied research in the affective domain could build a model for complex affective skill acquisition.

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Using The T.E.A.C.H. Act To Enhance Online Courses: Guidelines and Strategies

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Abstract

The TEACH Act was signed into law on November 2, 2002. There were two significant changes to the law: 1) rewriting Section 110(2) and adding a new Section 112(f). These sections now allow instructors in online courses to display and perform copyrighted works in greater amounts than before. This law recognizes the growing use and respect for online distance education, which will continue to grow at 20% per year by creating a new term in the law-"mediated instructional activities". Options for online course display and performance of copyrighted works have increased, though online uses of materials are less and more circumscribed than that of face-to-face instruction. Instructors must use an array of options to develop course materials: "fair use", royalty-free and public domain materials, the TEACH Act provisions to display graphic and perform audiovisual works, the Educational Multimedia Fair Use Guidelines when the TEACH Act does not address a particular use, and permissions. Strategies and resources for using the T.E.A.C.H. Act to develop and use online course materials are provided, as well as a checklist of "do's", "don'ts", and "tried and trues" to use in this process.

What Is the TEACH Act?

The T.E.A.C.H. Act is the Technology, Education And Copyright Harmonization Act of 2002 and was signed into law by President Bush on November 2nd, 2002. The TEACH Act amended the Copyright Act in two significant sections of the law: 1) by rewriting Section 110(2) and by adding a new Section 112(f). These sections now allow instructors of online courses to display and perform copyrighted works in greater amounts than before.

Why Is It Important?

This law recognizes the growing use and respect for online distance education, which is growing rapidly (Carnavale, June 13, 2003). Fall, 2002 enrollment in higher education was 1.6 million students, and will continue to grow at a rate of 20% a year (Carnavale, June 13, 2003). A recent study of 1,600 institutions found that a majority of academic leaders (57 percent) believed that the learning outcomes in online education were "equal to or superior to those of face-to-face instruction" (Sloan Center for On Line Education at Olin and Babson Colleges and The Sloan Consortium, 2003). This Act codifies the recommendations requested by the 1999 U. S. Copyright Office's Report. Moreover, research on online courses has shown that the average distance course is roughly the same size as a face-to-face course at a similar level, graduate and undergraduate (American Federation of Teachers, 2001; McKenzie, Mims, Kirby, & Waugh, 2000; Wolcott, 1997). Lastly, encryption mechanisms, while not "foolproof", have improved substantially (Talab, 2003).

Can I Use Materials in The Same Way As in Face-To-Face Instruction?

No. While "reasonable amounts" of materials may be used in online courses, it is still less than in face-to-face instruction.

> Make no mistake: While the TEACH Act is a major improvement over the previous version of Section 110(2), the law still imposes numerous requirements for distance education that reach far beyond the modest limits in the traditional classroom (Crewes, 2003).

What Are My Options, Now, for Using Materials in Online Courses?

The TEACH Act enlarges the amount and type of materials that can be used in online courses, in addition to "fair use" and the Educational Fair Use Guidelines for Multimedia (Harper, 2002). While permission is always an option, instructors can "shop" for the use that best suits their particular instructional needs. You have these options:

1. Rely on "fair use". Section107 of the Copyright Law applies to the use of works in reasonable amounts for instructional purposes in much the same way that they are used in face-to-face instruction. This use is in addition to the TEACH Act (Gasaway, 2001). Works that arenot allowed to be copied are works for the digital distance education market, unlawfully made works, textbooks, and coursepaks. Check to see if a

use is covered by “fair use”. More information on “fair use” can be found at the Stanford University Fair Use Site: http://fairuse.stanford.edu/

2. Use royalty-free and public domain materials. These include materials from the Internet that are legally royalty free, public domain, most government, or other works that were created for free distribution. For example, there are several sites that have royalty-free graphics, such as Public Domain Pictures http://camt.nyfa.org/artsites/. The National Archives Research Room http://www.archives.gov/ and Kathy Schrock's Guide to Educator's http://school.discovery.com/clipart. A site with an excellent list of royalty free graphics is at http://www.bsu.edu/library/thelibraries/units/copyright (Dolak, February 14, 2003). Most NASA images and all National Archives images are in the public domain. Doing a search on Google’s Image Search section (http://www.google.com) will retrieve many images, most of which are copyrighted, so it is wise to check each site that contains an image. Limiting the search to “.gov” will retrieve images that are developed by the government. Most government images are in the public domain, unless a government contractor has taken the option of copyrighting the work. In which case this will be stated on the site. Otherwise, search on “public domain”; “royalty-free” or “free” graphics will yield results.

3. Use the TEACH Act to display and performance of audiovisual works, such as film stills and clips (including opera), for music, etc. Laura Gasaway’s Comparison Chart for what may be performed and displayed in online courses is helpful in making decisions (http://www.unc.edu/~unclng/TEACH.htm). The American Library Association (ALA) has several sites that are also helpful. ALA often moves its sections around on the site. It is best to go to http://www.ala.org and search on the TEACH Act for Ken Crewes’ explanation of the TEACH Act and “Best practices” for using Blackboard. Other excellent resources on this Act are the “TEACH Act toolkit” at http://www.lib.ncsu.edu/scc/legislative/teachkit/. And the Center for Intellectual Property and Copyright in the Digital Environment at http://www.umuc.edu/distance/odell/cip.

4. When the length or use needed is not covered by the TEACH Act then turn to the Educational Multimedia Fair Use Guidelines. These Guidelines are not the law but were agreed upon by a large majority of educational media producers. In effect, these producers agreed not to sue anyone who uses amounts of materials stipulated in the Guidelines. This is a “safe haven” because they give more “leeway” in film clips, music, etc., and allow projects with these clips to be shown on protected networks. This is an important consideration when using PowerPoint and other programs for student projects. A facsimile of these Guidelines can be found at http://www.libraries.psu.edu/mtss/fairuse/guidelines.html and an explanation can be found at the University of Texas site at www.utsystem.edu/ogc/intellectualproperty/ccmcguid.htm/. Three short charts on using these guidelines with students can be found in Commonsense copyright: A guide for educators and librarians (1999). One is re-printed below (p. 213):

Table 1:Simplified *Fair Use Guidelines for Educational Multimedia Student Form – Example One*

Database/Table	Motion Media	Music	Images	Text
10% or 2,500 fields or cell entries	10% or 3 minutes	10% or 30 seconds from 1 work or extracts from several works	5 from 1 artist or 15 images from a collective work	10% or 1000 words

Credits:
1. When you use someone else’s work, give credit.
2. Place the copyright information on a “Credits” screen at the end.
3. Make a screen to show at the beginning that says “Fair use amounts used. Further use is restricted.”
4. If you follow these rules then you may enter your project in a local, state, or national contest.

How Can I Use These Options To Benefit My Online Courses?

The good news is that these options may be used together or separately. When approached from this standpoint then use is widened.

Basic Changes in The TEACH Act

This law made five fundamental changes that assist distance education (Gasaway, 2001; Lutzker, 2002).

1. The categories of works that can be performed now include limited and reasonable portions of works that used to require permission and/or licensing. However, this does not include using clips from works produced primarily for educational purposes. As an example, if you want to use a video from The Association for Supervision and Curriculum Development, which specializes in exclusive productions for educational purposes, you will still need their permission to transmit their material, which is produced for educational purposes.

2. That physical, face-to-face classroom concept of four walls, a ceiling and a floor, is now removed from consideration in the use of copyrighted materials. This is an acknowledgement of the reality of remote students in dormitories and homes. This important change now allows students to access digital materials in a course whenever and wherever they have access to a laptop or a PC.

3. The storage of copyrighted materials on a server is now allowed, which makes available both synchronous and asynchronous use of copyrighted performances and displays [within the limited portions restrictions, of course].

4. Digitized versions of analog works can be made that are not available in a digital format. In addition, digital works that are encrypted may be bypassed using a decryption mechanism, which is a direct contradiction of the Digital Millennium Copyright Act.

5. Faculty, staff and students involved in distance education are now able to legally store temporary, cache copies that are made due to the digital process of making digital transmissions. This was accomplished by adding §112(f) to the ephemeral recording section of the Copyright Law.

A New Format is Recognized in the Law: "Mediated Instructional Activities"

The TEACH Act finally recognizes "mediated instructional activities "(MIA). This is a step forward and requires that an instructor be present in an accredited non-profit educational institution, not a "diploma mill" or profit endeavor. The use of a secure network (password-protected) with software that prevents student copying ("downstreaming"—digital copying by students for themselves and others) is also required. For example, it is permissible to use a 4-minute clip from *Casablanca* in a distance education course. Of course, you must use less (fewer and shorter clips) than in face-to-face instruction, but transmitting these digital clips is specifically covered by the TEACH Act, which was a serious problem before the amendment, since online transmissions ("digital networks") were specifically not included in the old law (Crewes, August 15, 2003).

What Is A "Session" in the Act and How Does it Apply to My Course?

Unfortunately, the Act was written as though class sessions occur in a linear manner, instead of in the branching pattern of instruction, where all materials are present and students may access all or part of a course online at the beginning, as is the case with many online courses (Lutzker, 2002 and Gasaway, 2003). Since there seems to be no ready explanation for this approach, "chalk this up" to legislators' lack of knowledge of how courses are conducted in the online environment. However, based on this distinction it is possible to show a clip from *Real women have curves* in a Women's Studies class "session" (lecture #5) and then have students view this clip as they come to it, review this clip as necessary, and also for the instructor to show this clip later in the course in another session (lecture #7) if student understanding is found lacking through an exam.

> In September I used a film clip, consistent with TEACH, and I left it on the server for some short duration of a "class session." The students can no longer access that session. Today is November, and I want to emphasize a point and show once again the same clip. The TEACH Act does not bar the reuse of the same clip in the context of a second class session, whether you are reinforcing an earlier point or making a new point from the same work. (Crewes,

August 4, 2003).

Can I Use Clips From Educational Videos in My Course?

No. It is important to note that film clips from videos, dvd's, and the like are not permissible from producers whose main audience is the educational market. This harms their business and is, in the author's opinion, unethical. Copyright was designed to promote the "public good". Showing clips such as these not only harms the producers but also eventually reduces the amount of educational materials available to us all.

Who is Responsible If Infringement is Found In My Course?

The institution is actually held more liable than the instructor, according to the TEACH Act, because it is the institution's responsibility to educate faculty, disseminate information on compliance, and to provide secure networks for courses (Sections ___). On the one hand, instructors can use greater amounts of third-party materials in online instruction and their liability for these uses is reduced. On the other hand these provisions focus more on institutions, requiring that they develop copyright policies and impose restrictions on access (Lutzker, 2003).

Can I use copyrighted works as I would in the traditional face-to-face classroom?

No. Section 110(1) of the U.S. Copyright Act allows more use with the TEACH Act, but it is still less then face-to-face instruction. Additionally, the law does bar uses of audiovisual works that might be unlawful copies. This statute allows displays and performances. It does not address making copies of any works. For that issue, you generally need to turn to fair use (Crewes, 2003).

Can I Use articles that I would Normally Place on reserve at the library?

No. As previously mentioned, you are limited to less than in a live classroom in several instances. Link to the article. Better yet, give students choices of the articles that they may use and/or link to instead. It's better pedagogy, in that it requires students to use higher order thinking skills of analysis, synthesis, and evaluation when they search, select, analyze and evaluate articles on their own, and also makes students problem solve about what articles would best fit the assignment given. An added "bonus" is that the instructor benefits from this student research by continually refreshing her/his knowledge base with each new class. With the "hotlinking" capabilities of Blackboard and other online course utilities, students can automatically link to an article or click on Google or other search utilities to find similar articles, perhaps finding newer ones than the instructor did when conceiving of the course even a few months earlier. The author believes that these capabilities make many of these use issues moot. In the event that an article is absolutely necessary and is only available in print, then reserve is a necessary option. Displaying a portion of an article is also an option with the "fair use" exemption to illustrate a particular point.

Can I Link to Articles or Other Sites?

Generally, yes. Simple linking to authorized sites (like a public website) is not a copyright violation, unless you try to "deep link" (make the other site look like it's a part of your own) (Talab, 2000). Occasionally, a web author will request that no one link to a site without express permission. While the merit and legality of this request on such a world-wide publishing platform as the web is questionable, the instructor should honor it. Anyone who places this type of article or material on the web either has no secure "home site" to use for a presentation or for other purposes or lacks an understanding of the nature of the web and the fundamental benefits of recognition through the citation model. In other words, there is benefit to the old saying, " I don't care what you say, just spell my name right" that "oils the wheels" of academia .Additionally, "libraries should negotiate their database licenses carefully to be sure that they do not attempt to prohibit such linking" (Dolvak, 2003).

There are other concerns. The site may have questionable legitimacy. For example, a site may be a "front" for a political action party or other entity with a reason to present information in such a way as to draw a conclusion which is not based on fact. In short, they may "have an axe to grind". For example, a site on any controversional , political, or religious topic is ripe for such a use. A way to check the validity of a site can be done with a PC. Look to see what the host site is at the lower left bottom toolbar while the site URL is being accessed. If the site is managed by a biased group the site's host URL can be seen, indicating the basic approach to or reason for the site. Otherwise, it is best to link to related sites, if any are provided , that may indicate a site's bias.

Can I Show A Motion Picture DVD Clip?

Yes, if you can break the copy lock. A Princeton graduate student learned that depressing the shift key while the dvd was loading would defeat the copy mechanism, which caused the stock of the company to decrease by ten million dollars in one day (Foster, October 13, 2003). However, in practice, it is quite difficult to break the copy protection to get a clip. The TEACH Act allows the bypassing any encryption in digital works for limited portions. This is a problem with the law. The Digital Millennium Copyright Act [DMCA states that encyrption breaking is a potential criminal violation of the DMCA. The TEACH Act contradicts the DMCA and allows instructors to bypass encryption, a fact that the Consortium of College and University Media Centers drew attention to this year (Carnavale, March 28, 2003). This group was also responsible for developing the Educational Multimedia Fair Use Guidelines.

Does The TEACH Act Provide Enough Options for My Distance Education Course?

No. The best solution is to make judicious use of all options, listed above, to ensure that adequate materials are available to teach your course . This, in itself, requires a fair amount of problem solving. However, innovation is the hallmark of countries that utilize the concept of intellectual property protection. It's worth it.

TEACH Act Don'ts, Do's, and "Tried and Trues"

Do not:

digitize an entire literary dramatic work
digitize an entire dramatic musical work
digitize coursepaks
digitize or use digitized materials intended for the educational market

Do:

use "reasonable and limited portions" of audiovisual works
use "reasonable and limited portions" of dramatic musical works
use an entire NON-dramatic literary work
use an entire NON-dramatic musical work
link to a site rather than copying or digitizing the article

Tried and True:

Use the TEACH Act provisions, fair use, and the Educational Multimedia Fair Use Guidelines together
Teach students to problem solve and navigate the web by finding articles on a topic

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Peer Coaching: A Faculty Development Strategy to Improve Online Instruction

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Teaching in Unfamiliar Territory

By the time someone becomes a teacher, regardless of whether he or she enters the K-12 school system, higher education arena, or corporate training environment, he or she has literally had decades of experience with face-to-face instruction. While new teachers vary in their pedagogical training and student teaching experience, they still benefit from a lifetime of experience as students themselves. Accordingly, most of today's teachers have a fairly common set of experiences and expectations to draw from when planning and evaluating traditional instruction. This is not so when the educational environment is shifted from the four-walled classroom to the online Internet environment. According to Bork (2002), the results of a survey of university instructors revealed that experienced online instructors had taught between four and seven online courses either partially or fully online. While not an insignificant number, it pales in comparison to the teaching experience of the same respondents (e.g., 36% having more than 20 years of experience and 34% with 10-20 years of experience), as well as the non-teaching history that such instructors invariably had.

Moving into the comparably new territory of online teaching and learning thus requires a renewed emphasis on training and continual improvement. In their 2000 report *Quality on the Line: Benchmarks for Success in Internet-Based Distance Education*, the researchers at The Institute for Higher Education Policy (IHEP) identified twenty four benchmarks for ensuring effective online education. Among the faculty support benchmarks were the following:

- Faculty members are assisted in the transition from classroom teaching to online instruction and are assessed during the process.
- Instructor training and assistance, including peer mentoring, continues through the progression of the online course.

Reliance upon student and faculty self-reporting instruments as the sole forms of evaluation are particularly problematic since the online learning environment is significantly less familiar to participants than the classroom. Such unfamiliarity is likely to result in feedback which by itself is ill-suited to meeting these quality benchmarks. Incorporating peer mentoring or coaching into the instructors' training and support plan may enhance initial experiences with the online environment, which may contribute to improved teaching effectiveness. Furthermore, the use of peer coaching as a means of regular professional development will encourage faculty toward continual improvement of their online pedagogical strategies in light of increasing student and technological sophistication.

Peer observation and coaching activities are an accepted means of generating data for assessing teaching effectiveness; furthermore, the practice reinforces the concept that faculty are the best judges of institutional quality (DeZure, 1999). However, in the absence of established procedures and adequate training, peer coaching is benign at best and in many cases wastes valuable faculty resources.

Peer Coaching Cycle

Regent University has employed a method of peer coaching for face-to-face courses throughout the past six years. This method is taught in a year-long teaching improvement seminar. Participants engage in a coaching cycle with another colleague, sharing their findings with the larger group when the process has been completed. A team of experienced online instructors is currently adapting this peer coaching model for the online environment and has performed preliminary online peer coaching during this past academic year.

The peer coaching cycle used for face-to-face instruction consists of three stages: a planning conference, instructional observation, and a reflecting conference. The planning conference is a structured meeting in which the instructor and his/her peer coach discuss their collaborative effort with a particular focus on the goals of the instructor. Unlike other observation and feedback models, this peer coaching model does not promote open-ended feedback. Rather, during the planning conference the instructor briefs the peer coach on the specifics of the upcoming class session including such factors as the topic under consideration, the objectives for the session, the planned teaching and learning activities, the sequence and pacing of the session, and formal or informal assessments included in the session. With this background established, the instructor requests specific aspects that he/she would like the peer coach to observe. For example, the instructor may have difficultly sustaining a robust class discussion and would like the peer coach to observe the discussion dynamics and offer recommendations for improvement. It's important that the instructor have a clear purpose for engaging in peer coaching and can communicate such requests to the peer coach during the planning conference especially since feedback on topics other than these pre-arranged ones is generally off-limits. Such focused requests help to build trust between the instructor and coach, ensure that the observation and feedback will support the instructor's goals, and promotes genuineness and vulnerability (rather than an instructional "performance") during the lesson.

The second phase in the peer coaching cycle is the actual instructional observation. For face-to-face classes, we expect that the peer coach will spend between 45 and 90 minutes observing the selected class. The peer coach takes notes based on his/her observations of the class, using the planning conference requests as a framework. In addition, there are many observations which we encourage the peer coach to make, even if he/she doesn't directly communicate the findings to the instructor. The classroom environment, instructor placement and movement, student reactions, questions posed to the class (e.g., type, frequency counts, and even time between question and answer), interaction patterns, instructor mannerisms, content knowledge, visual aids, and use of class time are all facets which the peer coach could use to assist in the evaluation of the instructor's requests. Following the observation exercise, the peer coach is encouraged to review and organize his/her notes in preparation for the follow-up conference

The final phase is the reflecting or post-observation conference in which the instructor and peer coach meet to debrief the observed class session. During this meeting, the peer coach begins by providing the instructor with feedback based on his/her observations of the class. The feedback presentation typically includes describing the relevant observations, analyzing and interpreting the observations in light of the questions posed during the pre-observation meeting, and offering additional data which support the focus questions. After presenting such feedback to the instructor in an informational (vs. judgmental) manner, the peer coach elicits the instructor's inferences, opinions, and feelings. This provides an opportunity for the pair to dialogue about the observations and their consequences rather than having the peer coach simply debrief the instructor. The peer coach is discouraged from giving direct advice but instead to listen intently, ask clarifying questions, focus on the specific observations rather than offer personal commentary, and seek to agree together as to the meaning of the observations. The peer coach then closes the conference on a positive and productive note by helping the instructor develop an action plan to improve in the focus areas.

As a postscript to the peer coaching process, we have encouraged peer coaches to document their relevant observations in an essay or letter to the instructor as a means of helping the instructor use the experience for significant professional development. Furthermore, subsequent to the reflecting conference, the instructor is asked to comment on the collaborative coaching process (preferably in writing). This provides a final opportunity for reflection by the instructor and also helps to provide feedback which can be used to improve the peer coaching process.

Although the online peer coaching process is still under development, our initial efforts have largely been to adapt the three-phase cycle to the online learning environment. This has required some modification of the procedures to accommodate the uniqueness of online learning. For example, rather than the peer coach observing a face-to-face class session for 45-90 minutes, we recommend that the peer coach log into the Blackboard course site multiple times during the course of a week. Since the majority of our online classes follow a traditional semester schedule but break the lessons into week-long intervals (highlighted by asynchronous threaded discussions), one week in Blackboard is equivalent to a week's worth of face-to-face class time. In addition, we encourage the online peer coach to take particular notice of the virtual classroom environment and interpersonal communication dynamics. Such facets include the design and layout of the Blackboard Web pages, the tone of the announcements and course materials, the level of learner-instructor and learner-learner engagement in class discussions, the types of media used for presenting materials, the ease of navigation, the clarity of course instructions, and the instructor's mastery of the course content and effectiveness at presenting it to the class.

Peer Coaching Checklist

The collaborative coaching model can be presented in a checklist format as follows:

Pre-Observation Meeting

1. Identify the instructor's concern about instruction

2. Translate the concerns into observable behavior
3. Identify procedures for improving the instructor's teaching and students' learning
4. Setting goals and content, arranging time for observation, and choosing appropriate instruments

Online Classroom Observation

5a. Class online atmosphere
5b. Learner-instructor interaction
5c. Learner-learner interaction
5d. Mastery of content
5e. Manner of presentation
5f. Media for presentation
5g. Use of Blackboard and the Internet
5h. Design usability

Post-Observation Meeting

6. Provide the instructor with feedback
7. Elicit instructor's inferences, opinions, and feelings
8. Close conference on a positive and productive note
9. Evaluate the process

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Changes in Asian pedagogy: What would Confucius have thought! Continuation of a Series of Updated Reports

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Abstract

An examination Asian pedagogy and its relationship to instructional technology over the past five years, particularly the impact it has on Asian students who come to the United States to pursue studies in the field. A review of the findings sets the stage for what comes next – modifying the pedagogy model employed in Asia. Is such action possible? Should it be pursued? What are the consequences to those who teach, those who learn? The findings of the research team, discussed and illustrated through selected video excerpts, validate the original analysis of the problem – that culture impacts performance. Lessons and UCF model are suggested.

Introduction

Since the 1999 Denver AECT conference, a research team has been examining the impact on students from China and Taiwan when they come to the United States to study in instructional technology graduate programs (Cornell & others, 2002). The research originated following a series of observations as to specific behaviors exhibited by these students when in class. These behaviors, while not exclusive to Asian students (American and other international students often behaved in similar ways), reflected Asian communication patterns that created concern among their professors. The concerns related to student silence in face-to-face classes, accompanied by little significant participation online when such was required by their professors. Based on the information obtained from all subject groups, we designed a series of interventions to address the problems cited, at least in part. These included pedagogical strategies of a general nature and those targeted at students in the instructional technology graduate program. A series of video modules, produced in-house, related to assertiveness and accompanied an on-line print module. Especially interesting to us was that increasingly, the use of technology in instruction had been growing at what many would say is an unparalleled rate across Asia. We wanted to affirm through live video interviews, that when technology is employed within the context of Confucian-based learning, the role of both teacher and student changes drastically. Would Asian educational institutions seeking to inject their teaching with technology be able to seamlessly make the change? What roles would teachers have to take in this new techno-world? How would students react and how would teachers evaluate their performance?

Conclusions reached point to yet another problem, one of major proportions, that may or not be easily solved – the modification of extent Asian pedagogy that recognizes the changing role of the teacher/professor when technology use is integral to content mastery. It is our belief that, with technology in the hands of the student, the teacher/professor is no longer the locus of control. Such a change in authoritarian role may well be anathema to traditional Asian educators. Indeed, the Confucian model may well be under attack, at least in part, and this is the nexus of our concern. How can an educational system steeped in Confucian tradition of 2500 years or more, survive the onslaught of the technological revolution within the schools, be they at the primary level or within the colleges and university across Asia? Something has to change…or does it? Is there room for reconciliation herein (Trompenaars and Hampden-Turner, 1997)?

In the past few years, both China and Taiwan have initiated legislative mandates flowing from their respective Ministries of Education that, henceforth, both English as a Second Language and Computing will become core subjects of study from the primary grades onward. Other Ministries of Education across much of Asia have initiated similar mandates or at least moved along similar pathways.

A recent Beijing visit revealed that a new technology initiative aimed at the Western Provinces is in the making, one that will offer three variations of distributed learning via 1)E-mail; 2) satellite video feeds augmented by e-mail; and 3) Web-based instruction (Liu, Y.Q., personal communication, September 17, 2003). Western provinces were targeted because those in the Eastern provinces generally enjoy a higher standard of living and also considerably more financial support provided within those schools. While complete details about this initiative remain sketchy, the findings of the committee tasked by the Ministry of Education should be forthcoming near the first of 2004. What is not so apparent, either through discussions with Ministerial officials or through a review of the literature is *how* such initiatives will be implemented and the potential *impact* such initiatives may have on both those who teach and those who are their students. The Confucian model holds dear the role of teacher as being elevated above all else within a school. This same model dictates that the teacher is the ultimate master of the content taught. He or she is also *the* sole authority within the classroom, both in terms of what to teach and how as well as in matters related to personal conduct, philosophy, and values. Into this picture of authoritarian hierarchy now comes technology, and with it, an unaccustomed freedom by students to use technology towards their own educational ends. When technology is used in class, the teacher is no longer the ultimate authority; no longer is he or she the master of all knowledge and belief. Indeed, the teacher's role has changed, congruent with much now modeled in the West. This is akin to revolution, not evolution, and the impact of such massive change, be it implied or acted upon independent of what the teacher says or does, has major consequences on Asian pedagogy in the future. That future is now!

In an effort to seek renewal and fulfillment, we under took the task of trying to stem a potential tide of misunderstanding by those ultimately charged with carrying out the mandates imposed upon them in both Taiwan and China – its teachers and professors. *We originally referred to the plight of international students coming from his or her country to another for study, finding that nothing is as it should be*. Such a situation pales in comparison to the chaos that might be expected when we take the West to the East. The background Asian students bring to the West reflects an educational culture that saw its birth thousands of years ago, well before European and American scholars developed their educational theories. Plato (428-348 B.C.) and Socrates (470-399 B.C.) come closest as peers to Confucius (551-479 B.C) (Beck, 2002) for it is he, and his contemporaries who shaped the way education is currently practiced by well over one billion people. Or put another way, over a third of the world's total population.

Our initial work traced the pedagogical roots of a specific group of international students (all of whom were from either China or Taiwan) who came to *one university*, the University of Central Florida in Orlando, and enrolled in *one graduate program*, the Master's degree in Instructional Systems (http://pegasus.cc.ucf.edu/~instsys/,2002).

Its premise was (and is) that 1). Culture does make a difference, especially when two cultures have the possibility of engagement and that 2). These cultures are generally 180 degrees opposite to one another, sometimes while on a near-collision course.

Statement of the Problem

We expect that Instructional Systems graduates develop competencies that allow them to communicate to a variety of audiences, both verbally and in writing. They must be able to deliver presentations using a wide array of technologies. They must write papers that reflect both eloquence and conviction. They must work well as a member of a multi-cultural team and they must develop positive assertiveness. These competencies are introduced in the introductory Instructional Systems course, Survey of the Application of Instructional Systems (Cornell, 2001) and reiterated in Piskurich & Sanders (1998).

Western students, particularly those in North America, are generally adept at using these skills, given their innate tendency toward achievement (judged on what one has accomplished and one's past record), both professionally and socially. Other cultures function more on ascription (status attributed to one by birth, kinship, gender, age, one's connections, and educational record), a phenomena often seen in Southern Europe, Latin America, and Asia (Tropenaars & Hampden-Turner, 1998, p. 9). *For Asian students, acting on many of the competencies found within the Instructional Systems program proved unnatural, uncomfortable, and often induced considerable stress. The result – silence, both orally and in written documentation.* Could the reverse situation evolve when similar competencies are required of Asian teachers?

The overarching descriptor that guided our approach, we took from two works of Trompenaars & Hampden-Turner (1997, 1998), **"reconciliation!"** It implies neither being dominated by others nor acquiescing but rather, "…through an integrative process, a universalism that learns its limitations from particular instances, for example, and by the individual voluntarily addressing the needs of the larger group (p. 53, 1998)." The "larger group" consisted of the Asian students' Western peers, who numbered a little over half. In the coming years, this ratio of Asian-to-Western students may well change, with the numerical balance favoring Asian students! The larger group's needs were not immediately apparent as infusion of Asian students into the Instructional Systems master's program was not a one-shot event but gradual. We recruited one student at a time, until the critical mass gradually increased to where it is now at almost half the number of new students in the program. A similar trend is already apparent in the doctoral program in Instructional Technology where the critical mass of Asian students exceeds 50%! All these students from Asia (as well as those from India, Russia, Cyprus, and Turkey), regardless of from where they have come, bring with them their own idiosyncratic view of life. It is a pedagogical life that, heretofore, has been mostly unknown, by both the American students **and** their Western professors (2002, International Institute). Many professors know little about the basics involved in coming to the United States as an international student; they know even less as to the specific logistics; and have even less than less in-depth knowledge about the countries from which their international students have arrived!

Add to this scenario an un-enlightened American student population, both undergraduate and graduate. Our North American students are mystified by the silence of their Asian peers. They look to professors to encourage their Asian peers to communicate because they, the students, have little success, at least initially. Many professors remain perplexed for they also find their Asian students to be mute. How to evaluate muteness – that poses their immediate challenge! How to understand the Asian pedagogical culture and the degree of symbiosis between that culture and the one found at UCF – that was the challenge! Yet, we continue to insist that these students learn and study "our way."

Our approach was to seek understanding of what these students bring with them and so, we "went to the experts," professors from both Taiwan and China, and asked them about their formative education years. We asked them to describe how learning was for them when they were students, in grades anywhere from within their earliest memory of schooling to the time they completed their last degree. In this way, we obtained first-hand descriptions that may or may not validate what appears in the literature. However, it is not that we reject what the literature says about Asian education; we wanted to add richness and provide increased depth to what we experienced, thus our approach was to conduct live video interviews where possible. In this way, we validated major premises found in the literature and provided a qualitative database that clearly presents imagery that communicates the contrasts in pedagogical styles, East and West. Note, we did not say East *vs.* West; at least not yet.

Research Questions

Are there elements of the valued Confucian pedagogy that might be compatible with those employed in the West? Are there elements of Western pedagogy that might be in harmony with Confucian pedagogies? Are there implications that this research might have for students from other cultures? Are the findings of value to technology-based commercial organizations who engage in multinational commerce, especially given the current and projected increase in such initiatives in East Asia? In addition, is there symbiosis or asymbiosis – that is the goal we seek to address? Reconciliation between the cultures will be out outcome.

Brief Review of the Literature

Even a cursory review of the literature suggests images that stereotype our students, be they from China, Taiwan, or North America. It is tempting to label our Asian students as being passive, quiet, silent, submissive, respectful, intelligent, hard working, introspective, disciplined, and many other descriptors and, for some, these are accurate in their assessment (Tu, 2001). Hampden-Turner and Trompenaars (1997, op cit., p. 10) identify values differences between the West and East Asia in the business sense as having differing historical roots.

West	East
Supernatural religion	Secular humanism and enlightenment
Belief and faith	Paradigmatic assumptions
Cartesian dualism	The Way of Complimentarity
Values as things	Values as wave-forms
Cultures and Values –Yin	Cultures and Values – Yang
Pioneer capitalism	Catch-up capitalism
Finite Games	Infinite Games

We include these values sets because there is a continuing relationship between instructional systems designer competencies expected in the West by business and industry and the extent conditions the Asian students bring with them. This relationship often reflects the Yin and Yang depicted above. Hampden-Turner and Trompenaars define belief differences, those in the West being anchored in "…the commandments of supernatural beings and their sanctions for good or bad behavior in an after-life". (p. 10-11). In East Asia the authors cite value systems that, while varied across different countries, are based on "their wisdom being secular, practical and of this world." (p. 11). That "they are 'humanistic' in the sense that they aspire to improve the human and social condition, and failure in this leads to criticism and reappraisal. (p. 11).

In the literature, we found ample evidence of how things are. *We found little of help as to what to do about it, especially as relates to ways in which we might make the lives of the Chinese students in our program more positive.* We identified a number of categories wherein we gained insight as to what beliefs the students bring with them. As Trompenaars and Hampden-Turner assert, however, "you can never understand other cultures (1998, p.1) and so, while it is our intent to provide clarity as to Asian thinking, understanding might lie beyond our real capabilities. The best we can hope for is to create sensitivity toward the problems raised, and in doing so, perhaps emerge with observations and strategies that may make life for our students far better.

In support of this caveat is a statement read from another source, now disremembered (*Anonymous, N.D.)*, that described the feelings of an American expatriate in China who had worked there for more than 20 years. A new arrival to China asked him something to the effect of, "With all your years living in China, how long did it take you to understand the Chinese?" His replied, "I still do not understand them and probably never will." He added, "One cannot understand those from another culture unless they have been born or grown up with it!" So much for really understanding our Chinese students in Orlando.

In terms of what is valued and how it is manifested within the UCF classroom, the literature reinforces our own experiences. For example. An ongoing concern is the silence of Chinese students in our classes, especially during their first or second semesters with us. Is silence always "bad?" This question was posed us at an Orlando conference of the Comparative and International Education Society (CIES) by Dr. Haiyan Hua, Senior Research Associate of Harvard University's International Education Group. We were quick to respond in the negative, that no, there are many times when silence is, in fact, "golden."

We found evidence of why our Chinese students were silent in Brooks (1997) who was quoting Yum (1994): '…the Chinese communication process places the 'emphasis …on the receiver and listening rather than the sender or speech making' "(p.83). Brooks emphasizes Yum's point that Chinese are receivers of messages, listening, rather than being senders. She provides a pedagogical blueprint as to the nature of how Chinese students are educated:

> Confucius believed that…a hierarchal system was essential to the harmonious well being of society. This, in turn, is reflected in the Chinese classroom. Chinese students regard their teacher as all knowing, and the absolute authority on the subject matter….Chinese teachers are under severe pressures not to make mistakes, not to misguide students, and not to be criticized….It is the duty of students to give utmost respect to the teacher. To ask questions of the teacher…is tantamount to questioning the position of the teacher, and therefore is not a feature of Chinese classrooms. Since the teacher is the sole authority in the classroom, rigid order and formality are the main features of the Chinese learning environment (Su, 1995).

Zhang, Sillitoe and Webb (1999), in quoting Ballard & Clanchy (1991) compare Western and Chinese differences in the attitudes toward learning:

> "…in Western culture, tertiary education is oriented towards *extending* knowledge. Therefore, the teaching approach used and learning approach encouraged are designed to develop analytical and speculative abilities of students.…the [Chinese] education systems are mainly oriented towards *conserving* knowledge, and the learning approach fostered emphasizes the reproductive ability of students.

Tu (1999) reinforces these findings by stating that Chinese teachers have been accustomed to teaching where there was only one-way communication and a quiet environment. This no longer exists. All subjects are discussed, even the teacher's private life. Teachers fear the loss of their authority and the pressure of public opinion (p. 3). He (Tu, 2001) adds that Chinese collect information from non-verbal channels and perceive more exact information than has been delivered (p. 5). Lin and Yi (1997) add more pieces to our puzzle when they describe further issues faced by Chinese students that compliment those already discussed:

> International students from Asian countries are often stereotyped as quiet, reserved and non-assertive. These cultures place an emphasis on harmony and respect for authorities. Therefore, many of them are reluctant to share their feelings or emotions, express their opinions or oppositions to anyone, especially to authority figures….Asians tend to emphasize the importance of patience, harmony, respect and deference. Asian cultures tend to place a high value on team efforts of collectivity….Asians are also modest about their accomplishments. Many Asian international students feel uncomfortable with the individualism and the competitiveness associated with the American culture.

This is not to suggest a caveat, a series of excuses to fall back upon; rather, it is a reflection of reality for many. We cannot stereotype our students so easily, be they from Asia or Central Florida, having had students from both these sets of stereotypes. The common denominator, metaphorical in many respects, seems to be what was termed the "figure-ground" relationship (McLuhan 1964), i.e., that students will perform within parameters that are related to their most comfortable environment, whatever suits them at the time. In "McLuhanese" this concept is expressed as: 'Figure' refers to something that jumps out at us, something that grabs our attention. 'Ground' refers to something that supports or contextualizes a situation, and is usually an area of *un*attention (Gow, 1998). Mercurial in many ways, chameleon-like in adaptability – it's just what students do to survive!

The literature excerpts provided are but a tip of the pedagogical iceberg. It is our intent to continue surveying the literature continually to better gain understanding of our own Chinese students. Meanwhile, we are in the process of developing a methodology that will enable us to better understand the implications implicit in teaching Chinese students at UCF. We think that our findings may also prove useful to other North American institutions wherein Instructional Technology programs are offered. Ultimately, we envision the results we obtain as also being of considerable use to multinational corporations, many of whom hire many Asian employees. An initial description of our methodology follows.

We realize that what we include in this article, as well as in our presentations, may appear offensive to some, to marginalize some, to be found guilty of being patronizing to others…none of which is intended. We are taking observations as we get them, subjecting them to analysis, comparing them to other research found in the literature, and then attempting to devise useful strategies that will enable our Chinese and Taiwanese students to not only succeed, but to prosper! In effect, we are trying to level the academic playing field at the University of Central Florida so that there is equity for most, if not all.

What we were trying to do

The genesis of this study began a few years ago after the last author, having recruited numerous students from Taiwan and China into the Instructional Systems master's program at UCF, found that, while each student brimmed with enthusiasm, when it came time for communicating ideas in class, most remained silent. The students were always pleasant, respectful beyond belief, and had a work ethic akin to our forefathers. In class, when asked a question directly (as is typical in North American classrooms), they would look down at their notes, mumble soft words, most of which were unintelligible, and squirm uncomfortably in their seats, knowing that multiple eyes were upon them. When asked to post messages on an online discussion forum, the most one could anticipate from our Asian students was a perfunctory few words of acknowledgement, "Yes, I agree with her statement" or similar responses. Not much to go on as an evaluative tool. Then there were the infamous synchronous chat-rooms…where written paralysis was the rule for our Asian students, not the exception. The odds of the professor really knowing what the student knew were getting slimmer by the moment.

Another caveat: The instructor in this instance was one who evaluated performance based on what the students do, tied to performance objectives and goals that, more often than not, include project-based assignments, rather than conventional paper and pencil objective tests. In addition to individual and group assignments, emphasis is placed on participation, on the development and continuation of positive attitudes, of being self-motivated rather than having to be told what page to read or how many words were necessary in a paper to receive an A. He placed continual emphasis on teamwork, oral and written communication, as opposed to memorization of facts and figures. In short, his pedagogical model was 180 degrees opposite that typically followed by his Asian students! It was and is all about effective communication.

Methodology

It was decided to interview four separate and distinct groups of individuals, both composed of either teachers/professors or students from China and Taiwan.

By using these individuals as SME's (subject matter experts), we were authentic in our selection of subject class. We then needed to differentiate between the groups to provide focus on differences that might exist between them.

We decided to use four groups of ten, an N of 40, consisting of the following:

1. Teachers/professors who had been educated in Taiwan or China and *had not studied abroad.* We anticipated that the demographics of this group might be those who were more experienced and whose teaching would mirror much of the methodology they learned from their own teachers.
2. Teachers/professors educated in Taiwan or China who *had completed additional study in the West*, be it in North America, Europe, Australia, New Zealand, etc. and had since returned to teach in their homeland.
3. *Professors currently teaching at the University of Central Florida* from China or Taiwan.
4. *Students from China or Taiwan studying at the University of Central Florida*, preferably those enrolled in graduate Instructional Technology programs.
5.

Interviewee Questions

The researchers established two basic questions to which they sought answers from the Chinese and Taiwanese subjects. The subjects in three groups were teachers or professors from China and Taiwan. The fourth group was comprised of UCF students enrolled in the Instructional Systems/Instructional Technology graduate program areas.

The questions were:

1. When you were going to school (meaning any time between your primary school and graduate education), how were you taught and what were the recurring values that your teachers instilled in you?
2. Now that you are a teacher/professor, what strategies do you use when you teach and what values do you feel are important to instill in your students?

2a. A fourth group of both Chinese and Taiwanese was composed of current students enrolled at the University of Central Florida. In addition to question 1, above, we asked, "How are the instruction and the values you are learning here at UCF different than that you received at home?"

What we were (and are) trying to do is to get a clear picture of how our Chinese and Taiwanese students learned and what values they bring with them when they come to UCF.

Each subject was asked the questions posed while being recorded on video. The sessions were relatively brief, given that there were only two basic questions being asked. The subjects could reply in either Chinese (Mandarin) or English. If Mandarin was selected, the interviewer spoke Mandarin as well.

Transcripts of each interview were produced and analyzed. An analysis was made of key words across all groups and recorded in terms of similarity, frequency of use, and by category of interviewee. A series of figures was constructed that depicts the relationships between key words used and group type, thus profiling group differences in a more visible manner. An edited tape of relevant excerpts was abstracted from the raw footage that highlights the results of the taped interviews.

With the analysis of Asian (Confucian) pedagogical methods validated, efforts will be made to affect a comparison between these methodologies and those regularly employed within Western university classrooms, more specifically, those wherein Instructional Systems design students are enrolled. The reverse analysis is used to examine issues related to infusion of technology in Asia.

Preliminary Results

Confucian pedagogical influences upon Chinese and Taiwanese professors/teachers and their students

This is a longitudinal study in that, as time and financial resources permit, the data collection will continue until there is a numerical balance in intra-group findings. Following is a sampling of some of the interviews conducted thus far with the teachers and professors. They are summary statements arranged according to categories that will eventually appear in the matrices being developed. Reactions from students follow.

What it was like when I was a student is included in the first section and key elements were emerged and identified. These key elements were compared among the group1, group2 and group3. They are behaviors disciplines, deification of the teacher, learning objectives, interaction, educational media, and a strict classroom environment. When interviewees talked what it was like when they were students, they described how they were taught and how they learned. Comparing how they were taught and how they learned, there were some conflicts on behaviors disciplines, deification of the teacher, learning objectives and interaction.

Behavior and discipline

Group1 and Group2 (faculties with/without overseas experience) both expressed that they were taught to follow the traditional Chinese Confucian way of being a student. Being a student in Confucian way, the silence was addressed by lots of teachers and professors in the first two groups. They were taught to *"Be a good student, a good son and a good daughter. Must have excellent behavior." " Teachers teach us to be quiet, keep quiet, don't make noise, you just listen." " Be humble and do not speak too much. Just listen." "Silence is god. Don't talk too much."* By being taught this way, group1 and group2 were more conformed than the third groups. UCF professors, as the third group, emphasized their feeling against such Confucian behavior disciplines. When they are talking about the Confucian students' behaviors disciplines, UCF professors used ironic tones. *"I am afraid of them (teachers). They are horrible. They did whatever they want." "They didn't complain whatever the professor asked them to do"*

Deification of the teacher

The role of a teacher was deified and amplified due to its tradition (i.e., Confucius teachings). Teachers were treated as an authority in knowledge, values, and life experiences. All three group faculties shared the perspectives regarding to teacher's role. They expressed that *"teachers also play a high authority role. They introduced the knowledge and how to prepare for the exam", Teachers and professors are like fathers" "Teacher is the authority", "All that teachers said is the truth." "Social-status of teachers was very high"*

Regardless of how sufficient their knowledge and skills may have been, individuals were taught to be obedient and humble before teachers and they were required to look up to their teachers. All the faculties in the three groups respected their teachers very much. *"My parents asked me to: listen and learn, just be quiet, don't make trouble." "They are our role models" "We always admire our teacher" "we really respect teachers". "The teacher played a high authority role."*

As a result, teachers were among the top of the social hierarchy. Their teachings were like truth. Such high authority influenced students in many ways. One teacher in Taiwan said that *"I respected my teachers, and I had a dream of being a teacher as a child. They influenced me so much, so I decided to become a teacher."* In another way, most faculties expressed their conformation to such high authority without question. *"I dared not say anything against them. Their teaching method influenced me a lot." "What teachers said was right. I didn't fight against them." "You would respect to them whatever they said and whatever they did was up to them." "I thought of my teachers as persons of high social status. I couldn't challenge them"*

Learning objectives

All three groups of teachers and professors expressed their dissatisfaction towards the way their teachers taught them. When they were students, they are not sure of the reason to study so hard. The objective of learning seemed only for the exams. Under the exam-driven teaching methods and environment, their teachers did not relate their teaching and the real world. *"No one told me why I should do it, I was just asked to do it". "I didn't know why to learn this stuff as a result"; "We have to study hard. We have to work hard. We have to prepare many times to pass the exam.", "Pass entrance exam to study at a higher level." "Prepare for college entrance exam, work really really hard." "Pass the exam to survive to next level, from middle school, to high school, then to college." "Study hard and got good grades in the examination" "The goal was passing the exams" "Didn't work well to bridge knowledge and the real world." "I can not understand the relationship between what I learned in class to the real world"* Furthermore, UCF professors, based on their teaching experiences, complained that their teachers did not give them learning objectives each semester. *"We did not know what exactly we would learn during the semester in the class." "They just followed the subject day-by-day. You don't have the whole picture in your mind."*

Interaction

One-way interaction between the instructor and students was commonly witnessed. Three groups revealed a lack of interaction between teachers and students. The relationship between teachers and students is top-down. Students felt the distance due to the teachers' high authority and their teaching methods. Students won't ask questions in class. *"When I was a student, I wanted to get close to teachers, but I just dared not." "I was afraid to discuss with teachers or raise questions in class" "We have very few questions" "We have questions but very few. We would go to teacher's office." "I could ask questions of instructors, but they remained superior to me in a sense" "We seldom had access to the teacher." "It's not common for you to talk to the teacher after class. Students felt distant." "Students are afraid to ask dumb questions" "We were afraid to discuss our ideas with the teachers or raise questions in class". "Teachers were not easy to approach"*

All three groups of teachers and professors complained about their teachers' one-way traditional lecturing teaching methods. The instructors lectured and students listened carefully and bore in mind what was told them. Interviewees said that *"they lectured and we did all what they said for homework." "All lectures in every class" "Cramming instruction". "We were sitting there and just listened". "They didn't emphasize cooperative learning. They don't involve any activity" "They just use oral teaching strategies. There is no direct response." "They lectured a lot." "No activity at all" "They didn't give examples to explain some rules coming from theories"* Based on such one way traditional teaching methods, each of the two parties was held responsible for their own tasks. Interviewees said that most of the time they were listening and taking notes in class. *"Read the textbook for the examination. It doesn't matte if students listen to the teachers or not." " We just take notes." " We just followed the book." " We just follow. If we did something wrong, we had to do homework lots of times" "In terms of study,* *I just figured it out on my own" "They blame the student. It's the student's fault if they didn't do well" "Students feel much responsibility for their failure in exams"*

Not only were students asked to be good listeners and note-takers, but it was demanded that they retain the information as much as they possibly could. Although it does not sound interactive enough, students did not fight against the authorities. *"Teachers follow the textbook, to memorize the textbook seriously."*

Educational technology

Most of educational media employed included chalk and board, pictures, and tape recorders. *"Teachers just used chalk and the black board". "We recited the text and they asked us to listen to the audio tapes in the class three hundred times." "Teach by the book. Compare our performance to the tape. Very few recorders were available" "Teach by chalk and then do your homework" Since* traditional lecturing predominated teacher activities one faculty concluded, *"Using media to assist was not necessary".* Educational media use was rare; one teacher from the second group remembered that his teacher used some live samples to help teach. *"He took us to see all the live samples around campus, and then he took us to do science practice"*

Strict Classroom Environment

From the interviews, most of the teachers and professors are not pleased with how the teacher controlled the classroom environment. They all reported strictness within their classrooms when they were taught. *"The teacher controlled the classroom"; "During my studies there, I was taught to be disciplined. I was not allowed to be a rascal. I was taught about professionalism. It was close to being military training." Teachers need a lot of control in classroom." "When the teachers walk in. every student has to stand up for respect"*

What it is like now I am a teacher follows and several other major ideas emerged: teacher roles, learning objectives, interaction, educational technology, and motivation. There were lots of similarities about how they were taught. As to how they are teaching now, there are many differences among the three different groups.

Teacher Role

During interviews, teachers and professors without any oversea experience (group1) liked to talk about their roles as teachers. Some wanted to be students' friends. Some wanted to be students' mentors. Still others wanted to keep their authority roles. *"As a teacher, I emphasize knowledge delivery, mental guidance," "I feel more comfortable when I play a role of a mother as a teacher." "I will not allow my students to get too close to me" "I don't play an authority role" "I am demanding of my students. They do what I tell them to do" "I am not just a knowledge dispenser, but a guide of life experiences. I taught them values to conform to society."* Compared to the first group's diverse views of teachers' role, groups 2 and 3 faculties did not emphasize their roles as teachers too much. This was a very interesting finding. Like one faculty said *"I want students like me, and respect me. But I don't do anything deliberately to make them respect me more."* Faculties with overseas experience and UCF faculties may think the role of "teacher" is not as important in today's classroom.

Learning Objectives

Rather than talking about the role of teacher, Group2 and Group3 faculties emphasized their need to give students the big picture. Clarifying learning objectives seems very important for these faculties which reflects benefits received during their overseas' experience. *"I would like them to know they need to keep on learning all the time for their degree, or after they get the degree." "I will try to let them know what's going on." "I introduced the students to the whole picture." "I always taught my students "you have to keep your mind open so that you can learn as much as you can; do not get restrained by whatever the name of the department." "They can talk and ask you questions and even ask for some of advice about their career."*

Interaction

The lecturing teaching method is still the primary way of knowledge delivery crossing the three groups. When the interviewees were talking about their classroom interactions, there are very interesting differences among these three groups. Group 1, teachers without oversea experience, tended to emphasize teacher-students interactions. *"What I do is create more interactions in the activities. It takes more time and effort to prepare lessons, but kids like them. We are like friends now." "I would like my students to be closer to me than before." "Positive interaction between me and my students" "I like to share my experience with my students about how to use new technology to help each other and to collaborate." "We ask students to raise some questions. In this way, we have two ways communication"* However one faculty member mentioned *"my relationships with students were* *not really pleasant."* No matter positive or negative, they focused on the interaction between students and themselves. Group2, teachers with overseas experience, are more likely to talk about interaction between students themselves, for example group projects, collaborative learning. *"I use a lot of group discussion, a lot of team work." "They would discuss, they would present" "We do some group work, outside reading, gaming and problem solving and ask the answer." "We separate students in different groups. We let them to teach each other, and share the information." "They have to discuss their thinking with other senior students or a graduate student in our department, or just talk to their instructor or teacher" "I tried to arrange these discussions. In some classes, I tried to arrange the seats to give them a comfortable environment (to facilitate the discussion)."* In addition to the interaction between students, teachers in group2 also encouraged students to raise questions. *"I tried to encourage the students to ask, I always encourage them to ask, to stand up."* The teachers with oversea experience probably have more strategies to enrich their classroom interaction than those in group1. As a Western educator, interaction in classroom is a very common trend. Without deep understanding of the interaction in the classroom, faculties in group1 probably simply apply such trends by increasing the interaction between students and themselves. Beyond interaction among students, students and teacher, Group 3, UCF professors even mentioned their customized and flexible teaching strategies to meet their students' needs. *"I have group projects, but there are some students who just don't like group projects. In those cases I will just use few group projects and then do some individual projects because projects are supposed to be harder, bigger problems for student to work on and they can learn by talking to each other. They prefer to have group projects."* All three groups' faculties like to talk about their ways of improve the quality of their courses.

Educational Technology

New technologies are increasingly and continually being introduced. Thanks to these innovations, students are provided with alternative learning experiences. All three groups mentioned their using technologies to assist teaching. It was amazing that, from group 1 to group 3, the discussion about technology got more detailed, and negative attitudes toward educational technologies emerged in groups 2 and 3, especially in group 3, the UCF professors. Faculties in group 1 without oversea experience, all had positive words about using educational technology. However they did not mention how, rather than to just list the very broad categories of new technologies. *"We use audio visual material that follows teaching, audio tapes, video, VCD, DVD, and computer software to teach the students." "In my class, it is a new technology environment including multimedia, Internet, and so on."* Faculties in group2 with oversea experience, have more detailed opinions about new educational technology, even with some negative opinions on some particular technology, which means that they are really experimenting with these technologies to assist their teaching. *"I do not like to use transparencies or PowerPoint." "I tried to use multimedia. Although it is expensive, I still use it." "Usually I use my laptop, so I can connect to several links."* UCF faculties discussed their usage of education technologies in a very detailed way. They talked about problems that exist in current educational technologies. These problems we perceived as being barriers that interfered their teaching. *"I use Internet, course webpage, and use e-mail to interact with students. I put assignments on the web; post my homework and exam solutions, and course announcements - everything on the web. Also, students interact with me and use email quit a lot." " I told students to clean their email box, otherwise, I got lots of rejected emails." " I always have a Web site and even a bulletin board where they discuss problems." " I try to use Microsoft Power Point in teaching, but students didn't like it. So I went back to use the board. The reason is that use the board is that I can reuse the equation. Those are main parts I use in teaching. The students want to have time to understand. They want to follow the flow, follow the procedure how the equation was delivered right. There were a couple of semesters I use PPT. When I use PPT, it's very difficult to show every intermediate step. So what happened is that I show the equations on the board and then explain the procedure. But students fall to sleep, you know. They didn't like to respond at all. So I went back to the board."*

Motivation

All three groups' faculties used different ways of motivating students. Teachers without oversea experience focused more on a social and philosophical level. *"I taught them values to conform to society."* Teachers with oversea experience focused more on students' participation in classroom. *"I tried to encourage the students to ask, I always encourage them to ask, to stand up." "I asked them to use methods we have taught during the class. They can pick whatever topic that interests them." "I ask students to prepare something to report and to comment on these reports."* For UCF professors, in addition to encouraging students' participation, they provided more error-proofing motivation which the other two groups did not mention at all. *"I can't make them lose face. I told them" you can try more next time." "I have to encourage them instead of blaming them. Tell them screw-up one exam that's fine, try next time." "You can come to my office any time as a student. My door is always open."*

Western influences (i.e., syllabi) become salient in instructional pedagogy of the East in this case. Teachers measured student performance at both individual and team levels. Collaboration and coordination were foreign to the culture of long ago, but even now, the antecedents of that ancient culture remain deeply immersed in the new strategies. We hope that further research in these areas will bring together the values of both cultures, for we must nurture both.

Reactions from the UCF Students

Rather than ask our students how they changed when they became teachers, we asked them, "How are the instruction and the values you are learning at UCF different than that you received at home?"

Generally, the student responses reflected both positive and negative statements. Their replies to question 1 paralleled much of what the teachers and professors across all three groups said. Their answer to Question 3 seemed, as much as we could sense, a reflection of both their Confucian academic background and the degree to which they welcomed change.

Those students more open to new ideas and experiences delighted in the differences they found between Eastern and Western pedagogies. They were also more critical of their Western experiences, in a positive sense, articulating concerns as to variations between their various professors' teaching styles.

Most in both student groups found the intensive interactivity employed in class initially baffling but subsequently empowering. The more traditional students decried the perceived "lack of specific direction" to which they had become accustomed while those more inclined toward change welcomed it, recognizing that its intent was to foster self-initiative and motivation.

Since they were all instructional systems majors, they welcomed the plethora of technology use while, at the same time, questioned its use in terms of appropriateness by some professors.

Summary and Conclusions

A reflection of Confucian pedagogy emerged across all groups and its importance reflects the current environment wherein the subjects are located. A value set emerged across groups that reflect Confucian pedagogy with a consistent series of key words that identify specific teaching and learning attributes. The words and phrases we have included are a partial reflection of the data analyzed. The knowledge gained from the interviews provided a past, present and most likely future portrait of the relationship between Confucian pedagogy and the needs of our UCF Chinese students. The conclusions reached have parallel meanings for other students from Africa, Europe and Latin American wherein similar pedagogical hierarchies exist. The research provided the basis for proceeding with Stage II of the research, assisting teachers in China and Taiwan in adapting to Ministry of Education edicts that English as a Second Language and computer competencies be taught in the public schools. Indeed, perhaps we can nudge Alishan Mountain…a little bit at a time. Who knows...even the Great Wall may also experience tremors.

Significance and Need for Further Study

We view this research as being in its infant stages, with years of further work ahead of us. We are not unmindful of the sensitivity of our undertaking. We are especially concerned that our actions do not "change these Chinese students to the extent that, upon their return to their home environments, their effectiveness has been culturally emasculated" (Ying, N. personal communication, April 4, 2002).

Conversely, Chin-Ning Chu, in his work, *Thick Face, Black Heart* (1992), commenting on how one follows rules of what is right or wrong, states:

> We seek an understanding of ourselves so that we will know what we ought to do in any given situation. You will gradually replace the beliefs you were taught with the truths you discover. It is not whether you turn the other cheek that is important. *Why* you do or do not is most significant (p.37).

These two points might appear diametrically opposed to one another but even here there is symbiosis to the one who looks more deeply into these statements. We are beginning to understand far more about what our Chinese students are thinking and how they process the information we provide them.

The degree to which we either proceed toward cultural/intellectual emasculation or redefine what is "right or wrong" remains to be seen; indeed, our research must be conducted with the utmost sensitivity and tact; of this we are very well aware.

The qualitative/subjective statements of our subjects portend that we may expect similar expressions from professors and teachers in both China and Taiwan when Stage II begins – a series of focus groups held in both locations to ascertain teacher/professor attitudes toward the new technology initiatives now being implemented.

Our intent is to conduct these focus groups via video, on location in Taiwan and China. While the opinions and attitudes of educational administrators are always germane to the success of any new initiative, our aim is NOT to include such individuals within the focus groups. In this way, we are concentrating our efforts on the new target audience, teachers, and professors, for they will carry the brunt of the day-to-day work.

Our proposed solutions are numerous; some have been tried and proved helpful; a few have failed; others are being tested at this moment. Even more will emerge, we hope, because of the work done during Stage II.

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Information Technology-driven Education in Japan: Problems and the Solutions

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During the 1990s, Japan was behind other industrialized countries in embracing the IT revolution. Focusing on the field of education, this paper describes policies and actions taken by the Japanese government in order to catch up with other countries. Then, the paper reviews impacts of these policies and actions on Japanese education including improvements and problems. Implications of these impacts are discussed based on the findings of the empirical research.

Introduction of the Internet in Japanese Education

While major Asian countries have formulated national plans and taken action to incorporate Information Technology (IT) into their societies since the early 1990s, Japan did not enact a national policy until 2000. Kimura (2002) contrasted Japan with three other Asian countries (Korea, Singapore, and Malaysia) in their national policy related to IT. Singapore established its National Computer Bureau (NCB) and started working on its Civil Service Computerization Program in 1981. Since then, Singapore's government announced a series of national plans to promote the IT revolution (e.g., and Masterplan for IT in Education in 1997, One Network for Everyone in 1996, IT 2000 plan in 1992, and National IT plan in 1986) and carried them out. Korea and Malaysia followed by introducing IT plans during the 1990s.

National demand for the Internet

Although the Japanese government established a headquarters for promoting advanced information communication society in 1994 and announced basic plans for its IT revolution in 1995, no serious action was taken until 2000. During the 1990s, the IT revolution had been treated merely as a part of plans that were to promote deregulation and technological innovation. However, the Japanese government changed its viewpoint and started considering the IT revolution as a way of changing not only its marketing systems but also Japanese society itself. That change might be a result of the following factors: (a) The United States' economic prosperity, credited largely the growing information communication industry; and (b) Japan's backwardness in embracing the IT revolution compared with other nations in the Asia-Pacific region as well as major industrial nations. In 2000, the government organized the "IT Strategy Headquarters" and established "e-Japan" programs that aimed to "make Japan the world's most advanced IT nation within five years" (IT Strategy Headquarters, 2001; Ishikawa, Imamura, Taguchi, & Ueda, 2001).

The "e-Japan" programs established the following four priority policy areas: (1) building an ultra high-speed Internet network and providing constant Internet access at the earliest date possible, (2) establishing rules on electronic commerce, (3) realizing an electronic government, and (4) nurturing high-quality human resources for the new era (IT Strategy Headquarters, 2001).

The Japanese government's policies and actions

As shown in their goal to "make Japan the world's most advanced IT nation within five years" (IT Strategy Headquarters, 2001), the Japanese government emphasized the urgent need to promote the IT revolution. The goal of the revolution was to create a "knowledge-emergent society" in which all Japanese people can use and access information technology (IT Strategy Headquarters, 2001). In order to accomplish this, the Japanese government further demonstrated the need for "nurturing high-quality human resources" and proposed the following three objectives: "(1) all citizens need to acquire IT knowledge and skills to enjoy its benefits, and people's intellectual creativity and logical thinking power should be enhanced; (2) human resources who instruct IT to the public should be secured to improve people's information literacy, and (3) technical experts, researchers and digital content creators should be fostered to explore the frontiers of IT" (IT Strategy Headquarters, 2001).

Furthermore, a series of actions that the Japanese government needed to take in order to achieve the objectives was listed. First, in order to improve information literacy, the government addressed the need of "digitization of education" (IT Strategy Headquarters, 2001), that is, to enable IT-driven education by providing Internet access to all public elementary, junior, and senior high schools. In addition to enhancement of information literacy, the goals of IT-driven education included the following: to improve English proficiency since English was the most important language in the Internet era; to promote skills in mathematics and science to foster the ability of thinking logically; and to cultivate ability of self-expression and creativity. Concurrently, interactions via the Internet with other schools both inside and outside Japan to foster collaboration with people who had different cultures and viewpoints were encouraged (IT Strategy Headquarters, 2001).

Second, the government indicated a need to foster IT instructors by providing IT training for public school teachers. The goal was to enable all current teachers to instruct students using IT. In addition, a registration and dispatch system of IT instructors was introduced, so that persons with technology backgrounds in businesses and colleges could be utilized as IT instructors at schools (IT Strategy Headquarters, 2001).

Outcomes

Accomplishments reported by the Japanese government

Since the establishment of e-Japan programs, there has been a significant improvement in the number of public schools that have Internet access: the rate of those schools rose from 57.4% in March, 2000, to nearly 100% in Aug, 2002, as shown in the report by the Ministry of Education (2002). In addition, a series of projects has been conducted since the 1990s with the Japanese government's support to explore the advantages of using the Internet in classrooms. In these projects, nearly 100 schools were chosen and were provided with facilities for IT education. These schools demonstrated the effectiveness and potential of the Internet in education. Currently, the next project ("E square Project") is underway providing support for schools that utilize the Internet on their own or through cooperation with other schools (Center of Educational Computing, 2002).

Second, there has been an improvement in skills of IT instruction among public school teachers (e-Japan, 2001). The government's report shows that 781632 teachers (313271 in 2000) had participated in training related to IT education in 2001 (March, 2000 through March, 2001). Furthermore, in March 2001, 79.7% of the teachers (66.1% in 2000) reported being capable of "using the computer" and 40.9% (31.8% in 2000) of the teachers reported being capable of "instructing with the computer" (The Ministry of Education, 2001).

A gap between the government's report and reality

Ishikawa, Imamura, Taguchi, and Ueda (2001) identified several serious problems regarding the government-directed IT revolution. First, a discontinuity existed between the government and Japanese citizens in regard to the goals of the IT revolution. Although it had been widely acknowledged among citizens that the government had been focused on IT, little had been revealed about the details of policies (i.e., objectives and detailed planned actions). Ishikawa et al. (2001) attributed this discontinuity to ineffective and insufficient government public relations activities and mass media's indifference to the issue.

Second, Ishikawa et al. (2001) described the results reported by the government as questionable, since some results were too optimistic to reflect reality. In particular, a report that showed nearly half of the Japanese population had been using the Internet (up from 21.4% in 1999) might have not been true. Thus, Ishikawa et al. (2001) indicated a need to re-examine the appropriateness of the methodology used for data collection. If the report did not accurately reflect reality, the goals set by the government were not appropriate since these goals were based on faulty research (Ishikawa et al., 2001).

Finally, Ishikawa et al. (2001) expressed a doubt about the usefulness of the IT revolution itself, describing that there had been few examples that the IT revolution directed by the government changed the structure of the society as it intended. Although there was a flourish of IT related industries, which accompanied the endorsement of Clinton/Gore information superhighway in the United States, it might have been largely the result of the popularization of the Internet rather than the government's support. Moreover, those IT related industries had declined since 2000. Therefore, Ishikawa et al. (2001) predicted that there would be criticism directed against the Japanese government, which has been investing large amount of national budget into the IT revolution.

Based on observations at several elementary and junior high schools in Tokyo, Nakauchi (2001) listed a number of problems related to the use of IT at schools. One of the most serious problems was a lack of officially assigned system managers who were to protect a school's on-line security. At most schools, teachers who had more experience in using the computer relative to others were assigned to take care of the school computers. Not all those teachers were aware of the importance of security. Even when they were, it was often difficult to obtain the cooperation of other teachers, some who believed that computers had nothing to do with them (Nakauchi, 2001).

Second, Nakauchi (2001) pointed out a lack of experience and knowledge of using computers and the Internet among many teachers. For example, a teacher asked Nakauchi how to open "Yahoo!" on his personal computer which did not have an Internet connection; the same teacher also asked where he could purchase the "Yahoo!" application since his personal computer did not currently have it; some teachers deleted all the unused files including DLL and SYS files in order to make the computer work faster; and some teachers thought that they should not use the Internet in a classroom unless they learn and understand everything about the computer. Nakauchi (2001) indicated the existence of a digital divide within a school: teachers who were capable of using the computer and the Internet utilized the computer in class as it was necessary, while those who did not have enough skills rarely used the computers for instruction.

Moriyama (1996) stated that the encouragement (or enforcement) of connecting schools to the Internet might not have the desired impact on education unless we find an answer to the question of whether computers and the Internet are necessary in classroom or not.

The next section reviews research conducted in the United States and in Japan to explore what potentials and advantages the Internet brings into instruction and what should be considered in order to make the best use of the Internet.

What the Internet Brings Into a Class and How It Can Be Achieved

Findings from research in the United States

What effect does classroom use of the Internet have? Hemenway (2000) listed effects identified by high school teachers who used the Internet concurrent with classroom instruction at least once a week. First, the Internet impacted students' motivation. Students were highly engaged, saw things in a new way, explored on their own, discussed ideas, and became more anxious to do projects. This was primarily the result of the availability of information outside the classroom. The Internet "makes many resources, including original source materials from all over the world, available to students, teachers, and school administrators" (Reid, 2002, p. 30-31). This availability affected the roles of students and teachers. Students played the role of active learners who seeked the necessary information on their own and exchange ideas with their peers, while teachers played the role of coaches guiding them toward how to find information. The availability and change in roles resulted in an improvement of the quality of the motivated students' project (Hemenway, 2000).

In addition, the Internet brought great advantages to students in rural areas. Without the Internet, their resources had been limited to textbooks and references in a small library. However, the students could obtain up-to-date worldwide information with the Internet in easy and quick way, like those who lived in urban areas (Hemenway, 2000).

Findings from the "100-school Networking Project" in Japan

The 100-school networking project began in 1996 in Japan, sponsored by MITI (Ministry of International Trade and Industry) and the Japanese Ministry of Education, and supported and managed by IPA (Information-technology Promotion Agency), CEC (Center for Educational Computing), and CII (Center for Information Infrastructure). The purpose of the project was to conduct joint research to demonstrate the effectiveness and potential of the Internet in the field of education (Center of Educational Computing (CEC), 2002). In the project, approximately 100 schools were selected from 1,543 applicants and developed activities using the Internet on their own or through cooperation with other schools (CEC, 2002).

Akahori (1998) listed examples of the activities demonstrated by the participating schools including: collaborative learning in environmental education (e.g., an acid rain project in which 40 schools participated); report making by enlisting the aid of experts in social studies, in which volunteers answered students' questions; weather study by connecting to the weather bureau and having students compare weather charts with pictures produced by weather satellites; cross-cultural education by connecting to overseas schools; posting web-based questionnaires on the peace problems and having students discuss responses to the questionnaires from all over the world; and problem- based learning by connecting to specialists (Akahori, 1998).

Furthermore, Akahori (1998) summarized impacts of the Internet use reported by the participating schools. First, "the change of knowledge resources from a limited school space to expanded information resources worldwide" (Akahori, 1998, p. 1154) was listed. Traditionally, school resources had been limited to teachers' lectures and textbooks that were examined by the Ministry of Education prior to their publication. The expansion of resources via the Internet impacted types of students' knowledge from fixed to dynamic and alive (Akahori, 1998).

Second, the Internet enabled collaborative learning in which students exchanged different perspectives, which promoted cross-cultural understanding. Prior to the use of the Internet, individual learning had been dominant, which had provided fewer opportunities for exchanging ideas and ways of thinking through interaction with other learners (Akahori, 1998).

Third, Internet use changed the type of instruction and thus altered the roles of teachers and students. Prior to the use of the Internet, memory-based teaching had been the dominant style in which a teacher played the role of knowledge transmitter. The use of the Internet enabled a student-centered learning style in which students searched and retrieved information and further constructed their own knowledge structures through the problem-solving activities. In these activities, the teacher became a facilitator for assisting students solving the problem (Akahori, 1998).

Finally, communication via the Internet highlighted the importance of reading and writing skills, while "old media," such as face-to-face or telephone, focused on listening and talking skills. Several activities in the100-school networking project reported students' progress in reading and writing (Akahori, 1998).

Effective use of the Internet

As reviewed in the previous section, research has shown that the Internet has potential to improve instruction and to motivate students to become active learners. However, research also shows that the use of the Internet does not always impact instruction and learners as expected. For example, in Hemenway's (2000) interview with high school teachers, one teacher reported few differences in the classroom since he had started using the Internet. He commented, "Training is limited, we need more on how to use the tools. I don't have a sense of what is valuable, what I want them to produce, or how I would evaluate what I want them to do." (Hemenway, 2000, p. 118). Given the ambiguity of its utility and effectiveness, what should be considered in order to take advantage of the Internet use?

Integration of technology to instruction

Elsenberg (2001) argued that the goal of computer-based instruction was to lead students to become "computer literate" (p. 45), which did not simply mean a skill of operating a computer but addresses skills of using technology (not limited to a computer) flexibly and creatively. He esplained, "We want them [students] to be able to size up a task, recognize how technology might help them to fulfill the task, and then use the technology to do so." (Elsenberg, 2001, p. 46). Elsenberg and Berkowitz developed a process model named "The Big6 approach" to teach information and technology skills (Elsenberg, 2001).

The purpose of the model was to help people of all ages solve information problems. The model identified the following six stages that people were to go through when they sought or applied information to solve a problem or make a decision: task definition, information-seeking strategies, location and access, use of information, synthesis, and evaluation. Although these six strategies did not necessarily occur linearly, all stages were completed in almost all successful problem-solving situations.

The model aimed at helping teachers who were to develop instruction in which students learn "integrated information and technology skills" (Elsenberg, 2001, p. 46) instead of learning "isolated computer skills" (Elsenberg, 2001, p. 46) that used to be a focus of a computer-based instruction. Integration referred to using technology in content areas so that the students were able to complete tasks in more effective and efficient ways. Furthermore, students were expected to be able to apply technology-related skills to real situations and needs, that is, "to identify information problems and be able to locate, use, synthesize, and evaluate information in relation to those problems" (Elsenberg, 2001, p. 47).

Skills of integrating the Internet to instruction

Based on the stages of The Big6 approach, Schrock (2001) listed critical skills that teachers need to obtain in order to integrate the Internet in their instruction: searching for the target information, evaluating source (Web sites) of the information, and using models to incorporate the Internet use into instruction.

The skill of searching included selecting the appropriate search method and locating information. In particular, teachers must be knowledgeable of two basic methods of finding information on the Internet: directories and search engines. Directories such as Yahoo! Were considered to be useful when teachers were new to the Internet or need to gather some ideas to decide what information was needed. On the other hand, search engines such as AltaVista or HotBot could be useful when teachers had a focused topic and needed to combine relevant terms. To locate the information needed, teachers should be able to do tightly structured advanced searches by limiting and broadening a search (Schrock, 2001).

After locating the information, evaluation of the information and the source were necessary. Schrock (2001) presented criteria used in the evaluation: technical quality of the page and quality of the content. Technical quality included a consideration of the technical constraints at the school and at students' homes (e.g., the speed at which a page loads onto the computer's Web browser). Content criteria included the authenticity of the information, the authority of the author, the applicability of the information, and the presence of any bias. Furthermore, teachers needed to be aware of and to follow the copyright guidelines when using information from a Web site in a classroom lesson (Schrock, 2001).

When teachers obtain information from the Internet, they can create lessons that primarily use Internet resources and have students employ higher-order thinking strategies to complete the task. Schrock (2001) recommended Internet-based lesson model such as the WebQuest (developed in part by Bernie Dodge of San Diego State University). The WebQuest provided teachers with a workable model in which the Internet was incorporated into the curriculum. However, in order to use the WebQuest, teachers must acquire skills of searching and evaluating the target information on the Internet (Schrock, 2001).

Need for Teacher Training

The previous section shows that it is important for technology-based instruction to focus on "integration" rather than simply teaching the skill of operating a computer. In particular, in order to integrate the Internet to facilitate students' meaningful learning in a content area, it is necessary for teachers to know how to search and locate the information needed, how to decide what information should be used in accordance with its quality and affordability, and how to incorporate the Internet use into an instruction. The challenge is to equip teachers with these skills.

Petropoulos (2001) identified stages that were necessary for technology integration including budgeting and planning to get equipped with the required hardware, software and peripherals, making a plan to integrate technology with instruction, preparing teachers for the integration, guiding students in using technology to complete tasks, and looking forward to adopt new technology as needed. Petropoulos (2001) further argued that the most important step in the whole process was the third step (i.e. preparing teachers for the integration), which could be provided by an effective teacher training.

Discussing what was necessary for effective teacher training, Petropoulos (2001) identified problems in the current teacher training sessions that were often ineffective. First, teachers often were rushed through "one shot" training sessions for introducing technology. Second, most of the training sessions focused on learning technological skills such as learning software applications instead of integration. Finally, these training sessions did not provide teachers with sufficient time for reflection and practice. As a solution, Petropoulos (2001) argued that teachers would need time to plan, practice, search, and collaborate to develop curriculum-based technology projects. Importantly, teachers should realize that they did not have to be experts in the field of technology. Instead, they needed skills and experiences to integrate technology into their instruction (Petropoulos, 2001).

Currently, a number of training projects that focus on integration of technology are available, such as the West Virginia K-12 RuralNet project (Koul, Wiesenmayer, and Rubba, 2001) and the Educational Technology Professional Development Program (Ivers, 2001). In these programs, teachers' perceived level of technology proficiency as well as their self-efficacy beliefs toward teaching with the Internet are measured prior to the training and are monitored during and after the training to evaluate the effects of training.

Conclusions

The previous section reviewed research and projects that have shown that the Internet has the potential to improve students' motivation as active learners and their ability to complete tasks with greater quality in each content area. In addition, the 100-school networking project in Japan has revealed that the Internet enhances collaborative learning in a class, among classrooms and schools inside and outside of Japan, and between students and experts in the area. Furthermore, the findings in the project suggest that Internet use impacts types of instruction and learning, as shown in research in the United States.

The Japanese government realized the urgent need to promote Information Technology (IT) including in the field of education and have worked on the policy, "e-Japan." The goal was to create a "knowledge-emergent society" in which all citizens can use and access information technology. In order to accomplish the goal, the government planned to provide Internet access to all public schools to enable IT-driven education, which teaches information literacy as well as skills that were required in the "knowledge-emergent society" such as English proficiency, logical thinking skills, and creativity. Furthermore, the government provided training sessions to current teachers, so that all current public school teachers would become able to instruct using IT (IT Strategy Headquarters, 2001).

As a result, the government reported striking improvements in the number of schools that were equipped with Internet access and the number of teachers who were capable of "using the computer" and "instructing with the computer" (e-Japan, 2001; The Ministry of Education, 2001, 2002). The successful reports on the government-supported projects, including the 100-school networking project, highlighted the promotion of the IT revolution in Japanese education.

However, a number of researchers and school staff members have questioned the accuracy of the government report. For example, Ishikawa et al. (2001) argued that the report was too optimistic to reflect reality.

Likewise, Nakauchi's (2001) observation at schools indicated that environment and teachers were not ready to instruct using the Internet at many schools.

What causes the gap between the Japanese government's report and the reality of IT implementation? How should the government capture the reality in terms of readiness of teachers? And most importantly, what is necessary to be considered in order to improve Japanese IT education?

The Japanese government reported an improvement of teachers' IT using skills. The report was simply based on the increased number of teachers who answered "yes" to "being capable of using the computer" and "being capable of instructing with the computer". As Ishikawa et al. (2001) indicated, the vagueness of the research was apparent in several areas. First, it was unknown whether the answer had been based on each teacher's self-report or an observation by other teachers or a principal. Second, the statement "being capable of using the computers" did not address any particular skills that were required in teaching and completing school-related jobs. Likewise, the statement "being capable of instructing with the computer" was too vague to capture what exactly the teacher was able to do with the computer in order to promote instruction. Furthermore, the answers to the statements were categorical (i.e., yes or no) and did not refer to the degree of confidence.

In order to identify how much effort and to what point it is necessary to prepare teachers for integrating IT to produce effects, scales that measure each teacher's weakness and strength, as well as their beliefs about using IT in instruction are necessary. Importantly, the training sessions must evaluate an individual teacher's skill in order to identify his or her need prior to the sessions and after the session to track the effects of the sessions (examples of these measurement used in the training were shown in the West Virginia K-12 RuralNet project (Koul et al., 2001) and the Educational Technology Professional Development Program (Ivers, 2001)).

As reviewed, effective teacher training is critical for the successful integration of the technology. However, Misonou (2002) identified problems in IT training for teachers in Japan. He indicated that current training was mostly offered with a limited number of intensive courses, therefore, it would be difficult for many teachers to schedule for and to retain skills after the training. In addition, the training reflected little consideration of the needs and skills of each trainee. His suggestion should be applied to the government's plan regarding the training, which emphasized the need to provide flexible and various types of training, in which each teacher can choose to take what she/he needs and at her or his convenience.

In addition, Petropoulos's (2001) suggestions are critical. That is, it was necessary to provide teachers with time to plan, practice, search, and collaborate to integrate technology to instruction. In order for Japanese instructors to integrate technology both effectively and efficiently, it is necessary that findings from the projects such as the 100-school networking project be analyzed and shared by all teachers and schools. Currently, an effort to support schools on the Internet by providing schools with the findings of the projects and encouraging collaboration between schools has been made in the ongoing project (i.e., E square Project). However, in order to develop instructional designs that effectively integrate technology to instruction, collaboration should be expanded to include researchers as well as schools and teachers.

Although the Japanese government includes improvement of a variety of skills such as logical thinking skill in its plan, actions were primarily focused on skills and knowledge to utilize the Internet. However, it is more important for classroom instruction to develop the strategies to improve learning using available technology than to teach how to use a specific technology. Since the Internet is a fast-moving technology, incorporation of the newer technology will be required as they become available and commonplace (Schrock, 2001). Research that develops instruction to effectively integrate ongoing technology to take full advantage of it on learning in a content area is necessary.

Furthermore, the formation of the community based on mutual understanding among the government, local governments, researchers, and members of schools (e.g., administrators, teachers, students, and their parents) is necessary. The community should be able to support meaningful learning by students with the Internet by providing teachers and schools with proper training and facilities.

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THE USE OF ANIMATIONS IN CHEMICAL EDUCATION

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Abstract

A central issue in chemistry education is the relation between the macroscopic or real world and the molecular or nanoscopic world. New students could better understand chemistry and apply their chemistry understanding to solve problems if they were able to make deeper connections between these worlds. Animations can be used in chemical education so that students get a better knowledge of molecular processes by making better relations between the macroscopic and the nanoscopic world.

Twenty 10th grade, pre-university students from four different schools were distributed into four five-student groups, students of each group attended the same school. Group 1 received instruction on paper. Group 2 students were also provided with animations that showed nanoscopic processes. Group 3 received the same material as with Group 2, but the students were also required to complete assignments and perform a number of tasks for which they had to take a closer look at the animations. Students in Group 4 were required to do everything that Group 3 were required to do, and they were asked to make animations by themselves. The students were interviewed after instruction.

Only two students (from Group 1 and 2) could give a complete, molecular explanation why ice floats on water when ice is melting. Six students (two from Group 1, three from Group 3 and one from Group 4) gave an explanation that was correct, but not complete. The other twelve students could not explain this phenomenon. Solid salt and distilled water are insulators, but a solution of salt in water conducts electricity. Students in Groups 3 and 4 could explain this when they were performing the tasks about the animations. The Group 4 students made animations that were close to the scientific accepted models, which strongly indicate that creating animations gives a strong learning effect. Nevertheless, there was not a very clear distinction between the four groups when students were interviewed two weeks after instruction.

The students came from four different schools, and had therefore different backgrounds. There will be a follow up investigation in order to get a more homogenous group, which will result in stronger conclusions.

Introduction

A computer animation is a series of rapidly changing pictures on the computer screen, which gives an illusion of motion (Large, 1996). There have to be at least fifteen pictures per second for a fluent and continuous motion. According to Mayer and Moreno (2002) an animation has three characteristics. It is a picture, it shows apparent motion, and it is simulated. This means that an animation consists of objects that are drawn or created with some other simulation method. A video shows motion of real objects. Similarly, an illustration is a static picture of a drawn or simulated object, and a photo is a static picture of a real object. Computer animations can be used in instruction programs on CD-ROM or on the Internet. Movement of so-called gif-animations cannot be stopped; the animations cycle in a loop. Other animations play via a plug-in like QuickTime or Flash[1]. QuickTime animations can be stopped, so certain details can be viewed more closely. It is possible to play animations in programs such as QuickTime or Windows Media Player, and to copy frames of the movie. This allows students to interact with the animation.

Animations can serve different roles in instruction. Weiss, Knowlton and Morrison (2000) mention decoration, gaining attention, motivation, extra information and clarification of complex knowledge or complex phenomena as potential roles of animation. Gaining attention is an important function, in which there must be overlap with the content of the accompanying text. If there is no overlap, the animation can distract from the instruction. Large (1996) argues that animations add to written information, but cannot replace it. Motion is the special quality of animations and therefore animations can promote learning of dynamic processes (Large, 1996). Since chemical processes at the molecular level are dynamic, impossible to see, and typically quite hard to imagine, animation could be a powerful tool in chemistry education. Atoms, molecules and ions are not static, but vibrate, move, collide and interact with each other. These dynamic processes are better represented in an animation than in static pictures. Molecular-level animations have been proposed as a way to support student understanding in chemistry (Burke, Greenbowee & Windschitl, 1998). The rationale is that animations make visible otherwise abstract chemical concepts, especially those related to the particulate nature of matter.

Chemistry explains many processes from the real world with the abstract concepts of atoms, molecules and ions. The size of atoms, molecules and ions is typically several nanometers, so the world of these particles is sometimes called the *nanoscopic world* (Schank & Kozma, 2002; Vermaat, 2002). Other names are the *molecular world*, *submicroscopic world* (Ebenezer, 2002), or *particle world* (Bunce & Gabel, 2002). The name microscopic world (Sanger & Greenbowee, 2000; Wu, Krajcik & Soloway, 2001) suggests that the particles can be seen through a microscope. This is not the case, so the terms nanoscopic or submicroscopic are preferred. Because atoms and molecules cannot be perceived directly, chemists work with models or representations, constructions on paper, computer-based animations, or physical constructed models that have some properties of the real object. A 'good' model shows the appropriate properties of the associated object (Dieks, 1999). A goal of instruction is that students develop *mental models* that look like *conceptual models* that are accepted by the scientific community, and that students fit these models into a structure of related knowledge (Greca & Moreira, 2000; Seel, 2003). Mental and conceptual models are contrasted in Table 1.

Table 1.*The differences between mental and conceptual models (after Greca & Moreira, 2000).*

a mental model	**a conceptual model**
is a *personal*, internal representation, used by learners (mental models can be external if learners make sketches).	is a *public*, external representation, created by researchers, teachers, experts, etc.
explains and makes predictions about an associated system.	facilitates the comprehension or the teaching of systems or states of affairs in the world.
has to be functional to the person who constructs it.	has to be useful to the (scientific) community.
is incomplete, not exact, changeable	is more complete, more exact, less changeable
grows and becomes better if new knowledge is acquired.	is more or less full-grown.
can be quite different from the real object, phenomenon, or situation it should represent.	is a simplified representation of a real object, phenomenon, or situation.

Chemists use a range of representations to understand scientific phenomena. They switch between different representations and use them in a combined fashion to solve scientific problems, to predict certain phenomena, and to communicate with other chemists. However, students typically lack both the basic knowledge and the skills to work with different representations (Kozma & Russell, 1997). Because of limitations of representational knowledge and the skills to use these representations as objects of thought, students often do not understand scientific symbols (Kozma, 2000; Seel & Winn, 1997). They could better understand chemistry and apply their chemistry understanding to solve problems if they were able to make deeper connections between reality, the molecular world and the world of chemical formulas and equations (Herron, 1996).

Students should also be prompted to make relations between the three chemical worlds. Researchers hypothesize that the difficulties students face in relating elements among the three levels are at the root of their conceptual problems (Gabel, 1998; Nakhleh, 2002). Not only should students develop mental models that are scientifically accepted, but also they should use these models to explain and/or predict macroscopic phenomena. Furthermore they should be able to translate the macroscopic and nanoscopic world into the symbolic world and vice versa. Chemists communicate by chemical symbols, formulas and equations of the symbolic world. Instruction and assessment should explicitly address the relations between the three chemical worlds.

A process that is explained in the nanoscopic world is the floating of ice on water, a concrete phenomenon that is known to most students. In nearly all substances the solid phase is denser than the liquid phase, and when both phases are mixed, the solid phase will sink. This can easily be seen if one puts a bottle of olive oil in a freezer; as the oil cools and solidifies, it forms a solid on the bottom. In the Netherlands, 9^{th} grade students are taught a model for solid, liquid and gaseous phases (Figure 1), which explain this phenomenon (Camps, Pieren, Scheffers-Sap, Scholte & Vroemen, 2002; De Valk & Ousen, 2003; Hogenbirk, Jager, Kabel-van den Brand & Walstra, 1999). However, this model does not explain why ice floats on water. According to this model, a solid will be denser than a fluid, because in a certain volume of solid there are more molecules than in the same volume of liquid. In order to explain the lower density of ice, students have to change their mental model of ice and water.

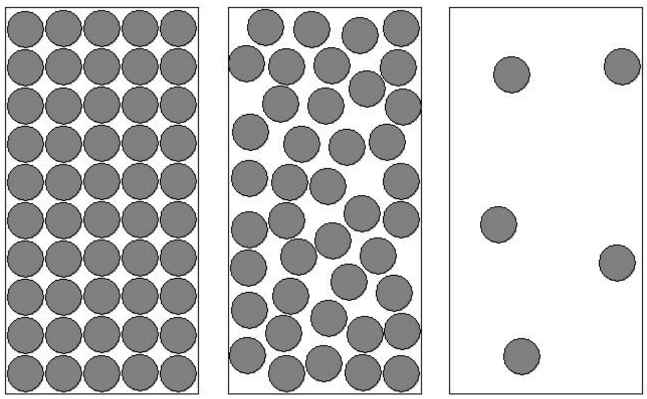

Figure 1.Models of a solid, liquid and gas, as taught in Dutch schoolbooks. Molecules in solids are immobile, in liquids there is motion, and molecules in gases don’t attract each other at all.

Another familiar phenomenon is the electrical conductivity of a solution of salt in water. Pure, distilled water and solid salt (sodium chloride, NaCl) are insulators for an electrical current, while a solution of salt is a conductor. Due to the curriculum in the Netherlands, 10^{th} grade students think that all substances consist of molecules or atoms. They know that an electric current is transfer of charge. To explain the conductivity of a solution of salt in water, students have to change their mental model of the building of substances, and to accept that there are substances that consist of charged particles.

Both the melting of ice and the dissolving of salt in water, which results in a conductor, are complex dynamic processes. Animation should therefore be a useful tool of instruction for these processes. Just showing animations in order to change the mental models of the students will probably not be enough. In an animation there are a lot of changes simultaneously, and it is difficult for students to recognize the conceptually important features of the animation (Schank & Kozma, 2002). Furthermore, students tend to hold to their old models, and disregard information that contradicts this model (Herron, 1996).

To change the mental models of the students, they should work actively with animations and recognize and comprehend the important features of the process. This can be done by completing assignments and performing tasks in which students have to take a close look at the animations. If students have to create animations by themselves, they will have to imagine carefully what the nanoscopic processes are. Students in earth science who created diagrams of what they learned about plate tectonics outperformed students who wrote summaries of their learning (Gobert & Clement, 1999). Students who make animations probably will develop strong mental models, which will be more in accordance with scientifically accepted models.

A tool that is used for students to create animations is ChemSense, a NSF-funded project by the Stanford Research Institute at Menlo Park, CA, U.S.A. (Schank & Kozma, 2002). The ChemSense team has designed software and activities to help students to connect observable, macroscopic phenomena with nanoscopic representations, and explain these phenomena in terms of the underlying, nanoscopic mechanisms. The ChemSense Studio supports the viewing, editing, and sharing of various representations, including animations. Students and instructors can comment on representations that are made by other students. Research by Schank and Kozma (2002) suggests that the use of ChemSense facilitates representational ability and understanding of nanoscopic mechanisms. The use of ChemSense requires students to think carefully through more specific aspects of chemical phenomena to which they might not otherwise attend. Students arrived at a shared understanding of the chemical content through their planning and discussion of animations.

The purpose of this study is to investigate how animations can be used in chemical education so that students gain a better understanding of molecular processes and improve their abilities to relate the nanoscopic and the macroscopic world.

Method

Participants

Twenty 10th grade, pre-university students from four different schools participated in this study. These twenty students were distributed into four five-students groups; students of each group attended the same school. In this way there was no contact between students of different groups.

Group 1 received instruction on paper (see **Materials**). Their teacher had already introduced the processes of the melting of ice and the conductivity of a salt solution during regular lessons, and the students had completed a test about these topics.

Students in Group 2 received instruction on paper too, but they were also provided with animations[2] (see **Materials**). There were no special assignments or tasks belonging to these animations, the students were just asked to take a look at them. During this investigation, these students also received instruction in their regular lessons by their own teacher about the processes.

The students in Group 3 received the same instruction materials as those of Group 2, but they were also required to complete assignments and perform a number of tasks (see **Materials**) for which they had to take a closer look at the animations. Group 3 students, just as those of Group 1, had received instruction about the processes by their own teacher during regular lessons before this research.

Group 4 students were required to do the same assignments and tasks as the Group 3 students, but they also made animations by themselves. Due to time restrictions, Group 4 students made only animations of the dissolving of salt. The students in this group were instructed by their own teacher about the processes of melting of ice and conductivity of a solution of salt *after* this research. That is, unlike Groups 1-3, Group 4 students had no prior or concurrent instruction on the relevant topics, which (in retrospect) makes it difficult to compare their results to the other groups. Some interesting results are discussed nonetheless, and this methodological limitation (which was due to logistical constraints) is discussed below and will be remedied in a future study.

Materials

The ***instruction on paper*** for the students consisted of copies from the textbook that is in use at their school. The students were asked to study these papers by themselves. For the students of Group 1, 3 and 4 these were copies from the textbook *Chemie* (Pieren, Scheffers-Sap, Scholte, Vroemen & Davids, 1999); for Group 2 students the copies came from the textbook *Curie* (Van Antwerpen, Bouma, Le Fèvre, Van Schravendijk, Schouten, Van Steeg & Termaat, 1998).

The ***animations*** shown to the students of Group 2, 3 and 4 were made by Roy Tasker of the University of Western Sydney, Australia (Tasker, Chia, Bucat & Sleet, 1996). The first animation depicted the melting of ice at the molecular level. Frames from these animations can be seen in Figure 2. The second animation depicted the dissolving of table salt (sodium chloride) in water. Group 3 and 4 students also heard a recorded voice, in English, that explained the process. The students were given a Dutch translation of this talk. In addition, there were animations of a hydrogenated chloride ion and of a hydrogenated sodium ion. Frames of these animations can be seen in Figure 3.

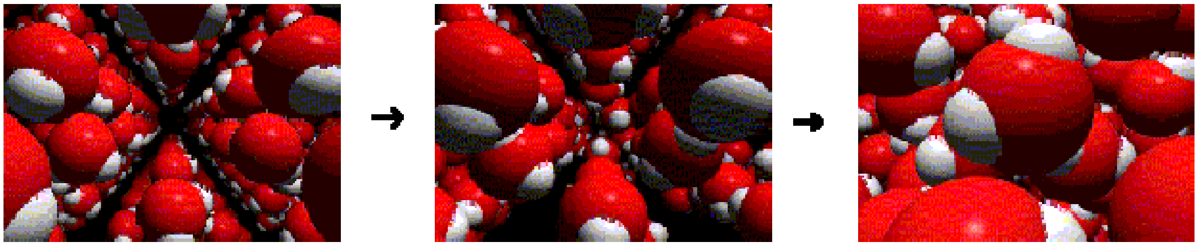

Figure 2. Frames from the animation 'Ice melting'

Figure 3. Frames from the animation 'Dissolving of salt'.

Students of Group 3 and 4 had to complete *the assignments* shown in Table 2 while working with the animation. Group 4 students used the ChemSense Studio[3] for making animations by themselves.

Table 2. *Assignments accompanying the animations*

Assignments for the animation 'Ice melting'

- Take a look at the animation and describe what you see.
- After how many seconds the ice starts to melt? How can you see this when looking at the water molecules?
- Where is more space between the water molecules, in ice or in liquid water?
- What is denser, ice or liquid water? Explain.
- Are there more watermolecules in a cm^3 ice, or in a cm^3 liquid water? Why?

Assignments for the animation 'Dissolving of salt'

- Are the gray balls sodium ions (Na^+ ions) or chloride ions (Cl^- ions)? Explain.
- Stop the animation at the moment the first (green) ion will be surrounded by water molecules.
- What is the charge of this ion?
- Which side of the water molecules is pointed to this ion, the side with the hydrogen atoms, or the side with the oxygen atom?
- Stop the animation at the moment the second (gray) ion will be surrounded by water molecules.
- What is the charge of this ion?
- Which side of the water molecules is pointed to this ion, the side with the hydrogen atoms, or the side with the oxygen atom?
- A water molecule is a dipole molecule, it contains a $\delta+$ and a $\delta-$ side.
- Explain that the hydrogen side of the water molecules is pointed to the chloride ion.
- Explain that the oxygen side of the water molecules is pointed to the chloride ion.

Instruments

All the students were interviewed about two weeks after the instruction. These interviews were semi-structured, the interviewer used the same open-ended questions for each student (Table 3). The interviewer asked the students to draw nanoscopic processes that show what happens if ice is melting and salt is dissolving in water in order to explain macroscopic processes.

Table 3 *The interview questions*

Questions for the phenomenon melting of ice

- What do you observe in the real world if ice is melting?
- Does ice float on water?
- What has the greatest density, ice or water?
- Can you give a molecular explanation (an explanation in which you use the word molecules) for the phenomenon that ice floats on water? Make a sketch that shows what happens to the water molecules if ice is melting, or what the difference is between water molecules in ice and in liquid water.

Questions for the phenomenon conductivity of solution of salt

- Can you describe what happens to the water molecules and the particles of which salt consists if salt is dissolved in water? Make drawings that show what happens.
- Can you explain why a solutions of salt does conduct a current and solid salt does not?

Procedure

The interviews took place about two weeks after the students had received the instruction.

Analysis

All the interviews were taped and the drawings were scanned. The results of all interviews were written down. After that, the explanations of the students were classified and analysed. Special attention was given to the nanoscopic explanation that students gave for the macroscopic processes.

Results

Melting of ice

In response to the question "What do you observe in the real world if ice is melting?" all twenty students eventually mentioned the change from a solid state to a liquid state. Eight students in their description started to talk about molecules. After the interviewer asked if they could see molecules, these students gave a macroscopic description.

All students knew that ice floats on water and does not sink to the bottom if ice is melting. Eighteen students said that ice is less dense than water (e.g., one said, "Water is of course denser than ice."). Two students, both from Group 1, thought that ice is denser than water.

The explanation of the phenomenon that ice floats on water relates to the unique arrangement of the molecules in ice and in liquid water. In ice the water molecules are held together by hydrogen bonds in a hexagonal, relatively open structure as can be seen in the left part of Figure 2. This orderly arrangement collapses during melting, and the molecules pack less uniformly but more densely (Jones & Atkins, 2000). During instruction, the students of both Group 3 and 4 formulated this explanation. However, two weeks later, no students from Group 3 or 4 were still able to give a complete explanation (Table 4). Six students were able to give an incomplete explanation, that there is more space between the molecules in ice than there is in liquid water. Half of the students held on to their old, limited model of solids and liquids shown in Figure 1. Two students invented whole new explanations involving 'surface tension' and 'loss or energy'. The last student could not explain what was meant by this concept.

Table 4 *Students' explanations why ice floats on water, two weeks after the intervention*

Group	complete explanation	in ice more space between molecules than in water	alternative explanation: 'old' model of solids and liquids	other alternative explanation
1	1	2	1	1 (surface tension)
2	1		3	1 (loss of energy)
3		3	2	
4		1	4	
totals	2	6	10	2

In sum, after two weeks, half of the subjects returned to the old model of solids and liquids, and only two students (in Groups 1 and 2) were able to give a complete, accurate explanation. Active use of animations did not lead to better explanations by Group 4 students, but this outcome could also be explained by the fact that Group 4 students had not received prior instruction on the topic. What is remarkable is how many students returned to the old model despite instruction with or without interaction with animations, illustrating how students' difficulties in understanding chemistry concepts often persist despite instruction (Gabel, 1998).

Dissolving of salt

All students knew that a solution of salt conducts an electrical current, but neither solid salt nor pure water does. The explanation for this phenomenon is that in solid salt, all the ions (charged particles) are held together by ionic bonding, so the ions cannot move. During dissolving, the ions are pulled out the ionic lattice by the water molecules. The water molecules surround the ions. The slightly positively charged hydrogen atoms in the water molecule are attracted to the negative chlorine ions, while the slightly negative oxygen atom of the water molecule is attracted to the positive sodium ions (Jones and Atkins, 2000). The sodium ions are smaller than the chlorine ions (ionic radii 98 pm and 181 pm respectively). In a solution of salt, the charged particles can move, which means that the solution can conduct a current. The students of Group 4 made animations in which they showed that they understood this process (Figure 4).

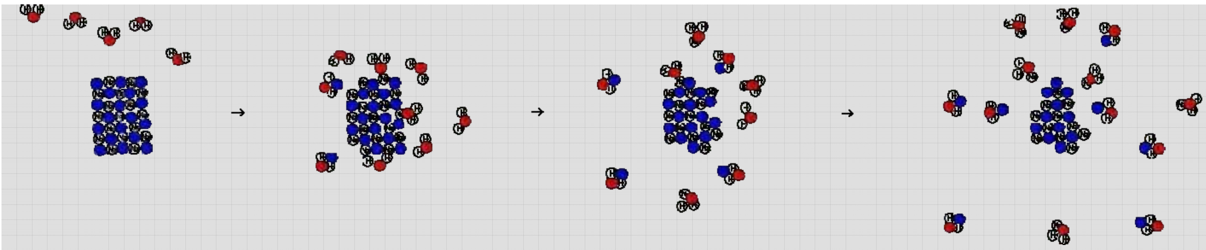

Figure 4 Frames from an animation made by a student of Group 4.

The results of the interviews are listed in Table 5. A complete explanation includes the following items:
in solid salts the ions are immobile;
in a solution the ions can move;
the sodium ions are positively charged and smaller than the negatively charged chlorine ions;
the ions in a solution are hydrated (= surrounded by water molecules);
the oxygen atoms of the water molecules are near the sodium ions, the hydrogen atoms of the water molecules are near at the chlorine ions.
In an incomplete explanation, students state that in solid salts the ions are immobile, and in a solution the ions can move, but they:
have inverted the charge or the size of the ions, and/or
drawn ions of the same size, drawn a wrong hydratation, and/or
used the formula HO_2 for water molecules, and/or
reversed the charges of the water molecule.
An alternative explanation lacks the immobility of ions in solid salt and the mobility of ions in a solution, which are the key features of this phenomenon.

Table 5Students' explanations of the phenomenon that a solution of salt conducts a electrical current, two weeks after the intervention.

Group	complete explanation	incomplete explanation (size or charge of ions, hydratation)	alternative explanation
1		4	1 (water is the conductor)
2		3	2 (hydrogen bonds; no explanation)
3		4	1 (particles vibrate)
4	1	3	1 (electrons are responsible)

Figure 5 shows two sketches made by students during their explanations. The sketch in the upper part of Figure 5 was made by a student who gave a complete explanation. This student said that the Na particles are positively charged sodium ions and that the Cl particles are negatively charged chlorine ions. The circle with the "3" in it represents an water molecule, which was sketched as in the upper right part of Figure 5. The sketch in the lower part of Figure 5 shows an incomplete explanation. Both charge and size of the sodium and chlorine ions are inverted, as is the charge within the water molecules.

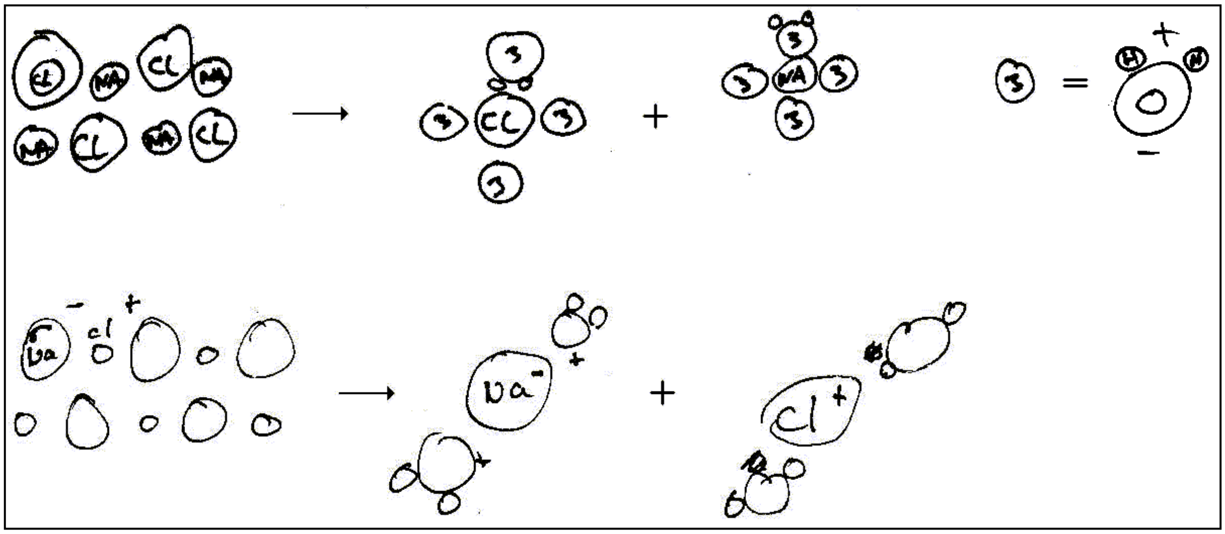

Figure 5 Sketches made by students during their explanation that solid salt does not conduct an electrical current, but a solution of salt in water does.

Discussion

It is remarkable that eight out of twenty students started to talk about water molecules when asked: "What do you see if ice is melting?" They knew this research was about the way chemistry is taught, and they probably connect the chemistry with the concept of molecules. However, this does not mean that these students actually link the molecular world to the real world. It is possible that the concept of molecules is an abstract concept, which has little meaning to them.

Half of the students held on to their old model of liquids and solids. This model is insufficient to explain the phenomenon that ice floats on water, and these students were not able to give a good explanation of these phenomena. In an informal conversation, a teacher mentioned that the model of Figure 1 has been 'drilled' in 9th grade students, and it may therefore be hard to change their mental model.

From the data in this research, it is not clear that an active look at the animated model of water molecules in melting ice promotes the understanding of this process. Three of the five Group 3 students gave an incomplete explanation (in ice more space between the molecules than in water. The two students who gave a complete explanation came from Groups 1 and 2. However, the students of Group 1 and 3 had already received instruction about this process before this investigation, so for them the instruction during this research is a repetition. A higher proportion of correct explanations from students in Groups 1 and 3 should therefore be expected based on their prior knowledge.

The animations made by Group 4 students are close to the scientifically accepted models. The students at once noticed some restrictions of ChemSense. They wanted to use the ionic radius for the sodium and chlorine ions, and the Van der Waals radii for the atoms in a water molecule. Furthermore, they expected green chloride atoms or chlorine ions instead of the blue ones they had to use in ChemSense. (In the time since this study was conducted, both ionic radii and more standard colors for atoms have been added to ChemSense). Even with the restrictions at the time of the study, the animations are quite detailed and accurate (Figure 4). All the significant features of the dissolving of salt are incorporated in the animation: in solid salts the ions are immobile, in a solution the ions can move, the ions in a solution are hydrated, the oxygen site of the water molecules is pointed at the sodium ions, and the hydrogen site of the water molecules is pointed at the chlorine ions. While they were making the animations, the students mentioned that the sodium ions should be smaller than the chlorine ions and that the sodium ions have a positive and the chlorine ions a negative charge. So their mental model had changed to the conceptual model.

The students of Group 1 and 3 had already received instruction about the process of the dissolving of salt, and the students of Group 2 were instructed by their own teacher during this research. The Group 4 students were instructed by their own teacher *after* this research. This difference in background knowledge may explain why Group 4 gave less accurate explanations during the interviews. Still, their explanations were as good as those from the other three groups, and the only complete explanation of the dissolving of salt was even given by a student in Group 4. This suggests that animation construction can be a powerful learning tool.

During the instruction, the students of Group 3 and 4 made clear that they understood both processes (melting of ice, a solution of salt conducts a current). Two weeks later they seem to have forgotten certain features of the processes. This resulted in incomplete explanations for both processes and alternative explanations for the conductivity of a solution of salt (particles vibrate, electrons are responsible; Table 4).

The students had a mental image of the floating of water on ice, and they knew that a solution of salt conducts a current, but they had not seen the processes itself at the start of the instruction. In order to enforce the link between the macroscopic and the nanoscopic world, the students should *first* see the processes and *then* get instruction in which molecules and ions provide an explanation.

For the first process, they could see a large beaker filled with water and ice. The instructor could point out the fact that ice floats on water. Then, the students should reason that liquid water is denser than ice, which means that there are more water molecules in a mL of liquid water than in a mL of ice. After that, students could be confronted with the model of Figure 1, and discuss whether or not this models is sufficient to explain the floating of ice on water. For the second process, the students could observe that neither pure water (distilled water) nor solid salt conducts a current, but that a solution of salt in water does.

A weak point of this study that the four groups of students came from four different schools and had different backgrounds. Ideally, it would be better if all the students were in the same classroom with the same chemistry teacher, but logistically, is difficult manage four separate groups in one classroom and to keep the groups separated. This can only be done if the students are interviewed directly after the instruction, otherwise they could talk to each other or observe each others' work, which would contaminate the measurement.

A follow up study with four groups from the same school will follow soon to find out if constructing animations give better learning results than only looking at animations and completing assignments about them. The animations of Tasker (Tasker, Chia, Bucat & Sleet, 1996) are better looking and more professional than students' animations made with ChemSense Studio, but there are strong indications that constructing animations gives a better learning effect than just examining them.

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All the participating students from the aforementioned schools.

[1] QuickTime and Flash can be downloaded from the Internet at http://www.apple.com/ and www.macromedia.com/ respectively.

[2] Animations: http://vischem.cadre.com.au/.

[3] ChemSense can be downloaded form the Internet at http://chemsense.sri.com/.

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Investigate the Impact of a Web-Based Learning Environment on Student Motivation and Achievement of Learning Science Concepts

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Abstract

A high school science teacher reported that the students have motivation and learning problems to understand the concept of fossilization. Working with the science teacher over eighteen months, Fossilization Web-Based Learning Environment (Web-LE, http://iris.nyit.edu/~skwang/fossil) was designed and developed by a group of students in the Department of Instructional Technology at University of Georgia to investigate the impact of the this tool on student motivation and learning achievement. The results showed that this Web-LE provided an appropriate tool for the teacher to teach the unit of fossilization, enabled the teacher to design specific assessment strategies, and improved student motivation. The teacher will use the tool in the future class since Fossilization Web-LE is customized for him and it is proved useful in his situation-specific context.

Introduction

The primary setting of this developmental research was a local private school located in a small city in northeast Georgia. This school is equipped with well-organized computer technology including computer labs, laptop, and wireless network. Students and teachers are used to the computer environment and equipped with relatively higher computer literacy. Some teachers in this school looked for strategies of integrating technology into their classroom. One tenth grade science teacher reported that he needed assistance to develop interactive instructional materials in order to solve his instructional problems. The team from the Department of Instructional Technology at University of Georgia analyzed his problems and decided to work with him. Twenty two months were invested on this project to conduct a developmental research and design Fossilization Web-LE. Fossilization Web-LE was designed to utilize the unique features and elements of the World Wide Web (WWW) to enhance and sustain the motivation of learners in the context of secondary science education. The project falls within the category of developmental research goals described by Reeves (2000). The purpose of developmental research is twofold: to focus on developing approaches to improve situation-specific teaching and learning problems and to generate methodological directions for design and evaluation for future development and implementation efforts.

Instructional Problems

The science teacher reported that the students have problems to understand the concept of fossil formation. Fossilization is a result of complex combination of an organism, ecological condition and physical burial. The fossil would be formed only under the correct situation. Students have to understand that how and why ecological conditions and physical burials influence fossilization. The teacher couldn't find accurate or useful materials to help students visualize the process of fossilization. Before the development of this tool, the teacher demonstrated volcanic films or pictures to help students to have a big picture of the fossilization conditions. He also asked students to pick up one condition and represent it by drawing. However, students could not understand the overall difference among the potential conditions of developing fossils. He needed moving illustrations describing different conditions of fossilization but he could not find appropriate materials to do so. The other problem was that students had relatively low motivation when learning the unit of fossilization. The science teacher needed a tool that is realistic and accurate to describe the process of fossil formation and provide opportunities for learners to consider the potential combinations of different decision. The learner will be able to identify situations that will cause fossilization.

Instructional Design Strategies

Several strategies for increasing students' intrinsic motivation will be involved in the Web-LE. First, Lepper and Hodell's (1989) four characteristics (challenge, curiosity, control, and fantasy) of tasks that promote individual intrinsic motivation were integrated into the instructional design. Second, raises and sustains learners' motivation by integrating multimedia objects into the learning context. Learning with multimedia provides an effective alternative instructional strategy (Mathewson, 1999). From the motivational perspective, using medium to assist instruction indeed enhance learners' interest (Freeley, 1982; Kramarski & Feldman, 2000). The multimedia objects were employed to represent the fossil concepts to enhance intrinsic motivation. Third, the teacher designed a task requiring higher order thinking skills for the unit of fossilization and encourages students to explore all scenarios to generate the conclusions instead of learning by rote.

Overviews of the System

After completing learning the concept of fossilization with this cognitive tool, students will be able to identify conditions necessary for fossilization and construct possible scenarios for fossil formation by manipulating the variables in the simulated processes. Fossilization Web-LE includes eighteen different scenarios to describe various conditions of fossilization and provides students the best way to observe most potential conditions to develop fossils. This is a three-day learning session. The teacher distributed the assignment in the first day and students had to solve problems within three days by exploring the scenarios provided the tool. These problems required critical thinking abilities such as comparing the similarities and differences and infer the conclusion.

When entering the Web-LE, learners will see the instructional page to explain the learning objectives and goals of the fossil unit as well as how to use the tool under the "manual" section .Figure 1 is the flow chart of fossilization cognitive tool created in Flash. After reading the task of exploring this interactive learning model, students will be prompted by the main interface of this tool. They have to follow the order of selecting an organism (first), an ecological condition (second), and then a physical burial (third). The combination of three decisions will decide whether the fossil will be developed and the simulation of fossilization begins after the combination has been made. The dinosaur is the only available organism in this version. Some abstruse terms regarding fossilization were identified by the teacher and illustrated by animations and descriptions in the online glossary. Students can assess to the online glossary to look up detailed information if they have any questions about the scientific terms.

The system will record paths that learners just made and help learners to identify the learning progress.

The complete eighteen possible combinations including:

Organism: dinosaur
Ecological status (3 conditions): temperate rainforest, tropical rainforest and tropical mountains
Physical burial (6 conditions): weathering, ashfall, lava flow, pyroclastic, swamp, and flood

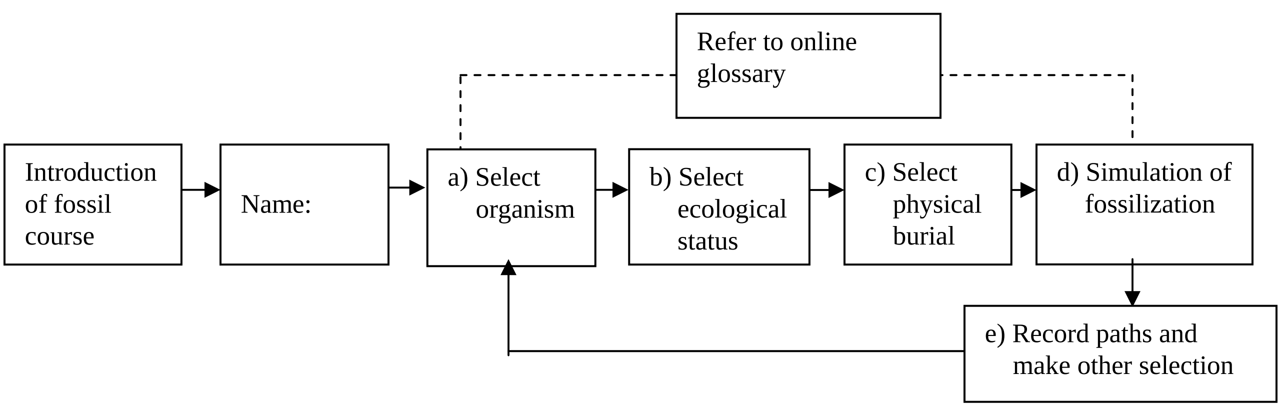

Figure 1. Flow chart of fossilization cognitive tool

Media development

The primary audience is high school students who are appeal to realistic graphics and animations, and their learning style is more visual oriented. The science teacher also requested for the realistic representation of the fossilization processes. Several endeavors were made to achieve the requirements. Referring to the accurate images, the dinosaur was developed with an accurate proportion and color. 3D software (Corel Bryce) was used to develop the realistic landscapes and objects including ancient plants, volcanoes, lakes and fossils in the fossilization animations. Flash MX (Macromedia) was the primary authoring tool because of its ability of integrating multimedia and the capability of optimizing media to enhance the speed of transmission on the Internet. The team met the teacher regularly and worked closely with him to conduct formative evaluation to ensure the graphical objects, descriptions of scenarios, information organized were accurate and realistic to the target learners.

Results

The teacher and twenty-seven tenth-grade students participated in this study, spending three class sessions using Fossilization Web-LE to finish cognitive tasks assigned by the teacher. Motivation questionnaire data were collected at the end of the third session allowing students to evaluate the tool and examine their attitudes toward using it. The student grades were also collected and analyzed to determine their learning performance. Observation, teacher interview, and twelve focus student interviews were collected during the sessions and after the three-day study was over.

The motivation questionnaire, observational protocol, interview questions were designed based on Newmann's identification (1992, p.13) of levels of engagement: (1) observable behavioral responses, (2) covert cognitive responses activated during learning, and (3) interest. The researcher carried out statistical analyses and correlation analyses to examine factors that might have influenced student motivation and learning performance. Newmann's levels of engagement helped the researcher scrutinize indicators of motivation that surfaced during the learning process. Student grades, student interviews, and the teacher interview were used to triangulate the data collected from the motivation questionnaire. The results showed that students reaped moderate learning and strong motivational benefit through using Fossilization Web-LE. Several minor interface design flaws were found during the implementation. These problems have since been fixed so that the teacher can use the revised program with future classes.

Lepper and Hodell's (1989) four factors for improving motivation were applied to the design of Fossilization Web-LE, and the tool had positive impact on student motivation as a result. Most students admitted that compared to other units, motivation toward learning fossilization was relatively lower without using the software; such statements reflected the teacher's statement of his instructional problems. Results collected from the motivation questionnaire and student interviews revealed an important message: student interest toward learning the topic of fossilization was higher when learning with Fossilization Web-LE. The results of implementation provided significant evidences that the tool solved the teacher problems. It enabled the teacher design various tasks that he could not do before using the tool and improved student motivation of learning the unit of fossilization.

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Design languages, notation systems, and Instructional Technology: A case study

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Abstract

Designers utilize design languages while they design. Notation systems, an embedded element of a design language, capture abstract ideas to create communicable designs. As a field matures, notations interact with design languages to improve both language and notations. This is important in the maturation of a technological field. The field of Instructional Technology can benefit from notation systems to record precise and minute details of designs in order to ensure correct duplication, execution and communication. It appears that a similar notation convention can emerge for instructional designers, but it may be many years or even decades before this happens. This paper illustrates a number of dimensions that can help designers form their design languages and select the characteristics of their notation systems.

"As the musician needs to record the precise and minute details of his composition to insure correct performance of his score, so the [instructional designer] needs a notation capable of equal accuracy" --George Balanchine

Overview

Designers utilize design languages while they design. Notation systems, an embedded element of a design language, capture abstract ideas to create a communicable design. As a field matures, notation systems interact with design languages to improve both language and notations. This is important in the maturation of a technological field.

The field of Instructional Technology can benefit from notation systems to record precise and minute details of designs in order to ensure correct duplication, execution and communication. The need of a recording system in dance served as an impetus for a dance notation system; a similar need in instructional technology is no less important or critical. A case study of dance notation to derive important principles for instructional technology design notation systems is used.

Dance Notation

A dance notation system is analogous to a musical notation system; it records the entire character of the score including information for musical counts, measures, rests, body placement on the stage, head direction, feet placement, arm movements and placement, action, interaction between multiple dancers, time signature, lighting, stage design, props, and many other aspects of the production. "It is an agreed-upon notation for capturing abstract [dance] designs in graphical, textual, and symbolic representation (Gibbons, work in progress)."

Dancers are expected to memorize movements of ballets they perform, requiring continual classroom and "take-home" practice. To facilitate take-home practice, study guides are written to remind dancers of their movements in the ballet. These study guides are written using a notation system that identifies the body position, movement timing, and other important information already described. This case study examines two dance notation systems: (1) Labanotation, a geometric dance notation system used for centuries, and (2) the Sutton Dance Writing Method ®, which has used iconic caricatures to record dance movements since 1973. These notation systems also allow for the composition of new ballets, making them an invaluable design tool for choreographers. Without notation systems like these, dance designs would be limited by memory and hard to transmit across time.

There are a great many aspects of a ballet production that must be weaved together to create a wonderful, meticulously crafted dance production. The various layers of dance design call for artisans experienced with the different layers of dance. For instance, people study costume, set, and lighting design for many years, both in school and in apprenticeships before becoming responsible for a major production on their own. Each of these specialists must work within their own design language that becomes aligned with the main plan for the entire dance production itself, thereby necessitating the precise nature of that plan.

History of Dance Notation

The world of dance is characterized by competition and creativity. The notation system was a key factor in the evolution of the field. Notation systems can be textual, hieroglyphic, geometric, or a combination thereof. As dancers advance in the study of ballet, they learn a notation system that provides a public, portable record of movements in a dance they are learning.

The history of dance notation begins with a pervasive oral tradition of ballet. In 1588 Arbeau published Orchesographie, which only notated movements of the arms and the body. The number of symbols was few because dances were limited to only a few movements and patterns in those days. The dance step symbol was written next to the note to which the movement corresponded on the accompanying musical score. This notation was meaningless to the unversed, but it was useful to dancers, and was in use after 200 years of its invention (Watts, 1998).

The founding of the first dance academy, by Louis XIV, served as a stimulus to institute a notation system when the need to create and communicate production information increased. From this point on, ballet flourished and the variety and artistry of dances developed rapidly. This period saw an age of shorter costumes, softer shoes, expressive use of arms and body and a greater precision of the timing of movements. This, in turn, provided an increasingly sophisticated variety of dances to be recorded. Several choreographers attempted to use stick figures to notate their dances. These systems were the forerunners of modern notation systems, represented today by the Labanotation and Sutton Methods: two among dozens of notation systems that have been invented.

Notation systems and design languages

So far in this paper, we have been describing notation systems. We have also described how notation systems are essentially symbolic systems for representing designs that are conceived in a design language. Specialized design languages of the choreographer, the stage manager, and other production staff members must align with the dancers' language and the notation system makes the choreographers' design language expressions public so that coordination and synchronization can occur and as a means of advancing the complexity of production design. It is important to distinguish the notation system, which is public and concrete, from the design language, which is personal and abstract.

What is the relationship between abstract design languages and their concrete terms and notation systems? "Written musical notation is not music design language. It is simply a good visible representation of the terms and relations that exist in the musical design language in the mind of the composer" (Gibbons, work in progress) and in this case the choreographer. "Notation systems give imperfect but visible expression to design structures; they grow with—and help to grow—the design language itself (Gibbons, work in progress)."

> [The] mutually supportive relationship between the abstract design language as it exists in the designer's mind and the notational system used to express designs publicly is a very important one, and it is the reason for discriminating between a design language and its visible, public representation. The notation system becomes the first necessity for a design language to grow and mature beyond its often vague and limited rudiments. Until there is a system of notation (even a primitive and completely personal and idiosyncratic one), the precision of designs, and the expression of increasingly complex and nuanced designs is not possible, and designers become captured by the process of manufacture (Gibbons, work in progress).

Design language – notation system interactions

The evolution and elaboration of dance notation systems was the visible outcome of an increase in the sophistication and detail of the abstract design languages emerging in the choreographers' minds. The notations were useful tools for the choreographer to communicate dance plans to dancers, production workers, and other choreographers. But the design languages and the notation systems were both capable of independent change and improvement. This is because of a mutually beneficial resonance that is set-up when symbol systems are used to externalize abstract designs. As designers improve and extend their personal design languages, this in turn calls for extensions and improvements to the notation system (See Figure 1). The notation system then is capable of expressing more interesting and complex designs and easily leads to innovation. This interaction between notation system and design language was a

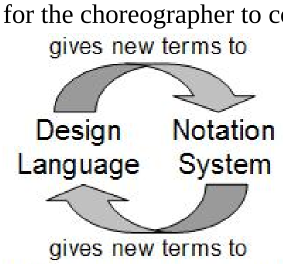

Figure 1: Cycle of Improvement

primary vehicle for the blossoming of Western music in all its variety following approximately 1000 A.D.

Once a consistent notation system is established, if it is used with discipline, it can become: (1) a tool for remembering designs, (2) a structured problem solving work space in which designs can take form, and (3) a kind of laboratory tool for sharpening and multiplying abstract design language categories. It permits ever more complicated and interesting structures to be built and new dimensions of the design language, such as musical harmony, to be considered and explored in detail. Moreover, as these experiments yield new insights into the design language, they find expression through corresponding growth of the notation system. Thus, through a continuing cycle of refinement, both design language and notation system grow together in parallel, and more sophisticated technological ideas can result.

> "The qualities of a notation system, have major impact on the rate of growth of the related design language. Prove this to yourself by first multiplying two roman numerals and then multiplying the same quantities using Arabic numerals. It is not hard to see the great facilitation to designing numerical expressions and computations that comes from our current number system and its rules for place value representation. Without these both, algorithmic multiplication would be much more cumbersome. This example and others that could be given constitutes a rich field of exploration for those who would design notation system principles and design languages (Gibbons, work in progress)."

Dance notation basics

When analyzing a dance notation system, there are basic elements to look for. It is vital to remember the needs of the dancers, choreographer, stage designers, lighting crew, director, producer, and stage hands. It is important that all involved with the production are able to follow the dance score and adjust their activities in support of it. For instance, it is imperative that the stage designer, lighting crew, director, and producer know the interplay of the participants, so that they can design the stage, props, and organize the lighting so as to make the performance run flawlessly. A dance notation system is the common public language that all players possess with which they communicate and coordinate their individual plans.

The basic elements of a good notation system would include symbols representing dancers' positions on the floor, arm, leg, and head direction and movements, interactions with additional dancers, moods of the movement, measures, speed, and any applicable musical notation including time signatures, repeats, timing, and measures. Although both methods of dance notation included in our study contain these vital elements of a good notation system, we have observed important differences between the systems that may teach us something about the characteristics of a good notation system of any design field. For the remainder of this paper we will compare these two systems and draw out principles we feel transfer to the work of instructional designers.

The Labanotation System

Kinetographie was a notation system for recording human movement originally developed by Rudolf von Laban. It was modified in the U.S. by many, including Ann Hutchinson Guest, to become what is currently referred to as Labanotation.

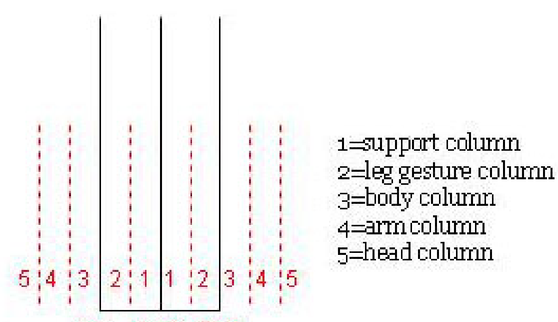

Figure 2: Labanotation basic staff structure (after Griesbeck, 1996)

Labanotation is written on a staff consisting of three vertical lines. Figure 2 shows this staff in solid lines. All movements performed on the right side of the body are noted on the right side of the staff, and all movements performed on the left side of the body are noted on the left side of the staff. The dotted lines, not usually shown in dance notations, represent subdivisions of the body and symbols are placed in these columns to show movements and positions of the legs, body, arms, and head, respectively. The score is read from bottom to top (Griesbeck, 1996).

This method of notation is thorough and quite accurate. Figure 3 is a composite of several detailed standards of this system. The rectangular diagram on the left of figure 4a (reading from bottom to top), shows a notation sequence of three basic dance positions, using Labanotation. The positions being performed are shown on the right of figure 4b. Figure 5 shows how the length of symbols corresponds with musical notation timing.

Once a dancer acquires the advanced skills necessary for Labanotation, he/she has a tool with which to record many forms of human movement including sports movements, like ice skating and martial arts. This method of notation becomes complicated and confusing with the addition of extra parallel staffs and symbols for additional dancers. Additional information that must be recorded for complete works are body position, timing, direction, position, arm and leg gestures, center of weight, transference of weight, phrases, and floor plans for all dancers in coordination. For instance, Figure 6 is a simple example of one musical measure (4 beats) of a ballet movement for one dancer. Once all the elements of the dance are in place, the score is difficult to read.

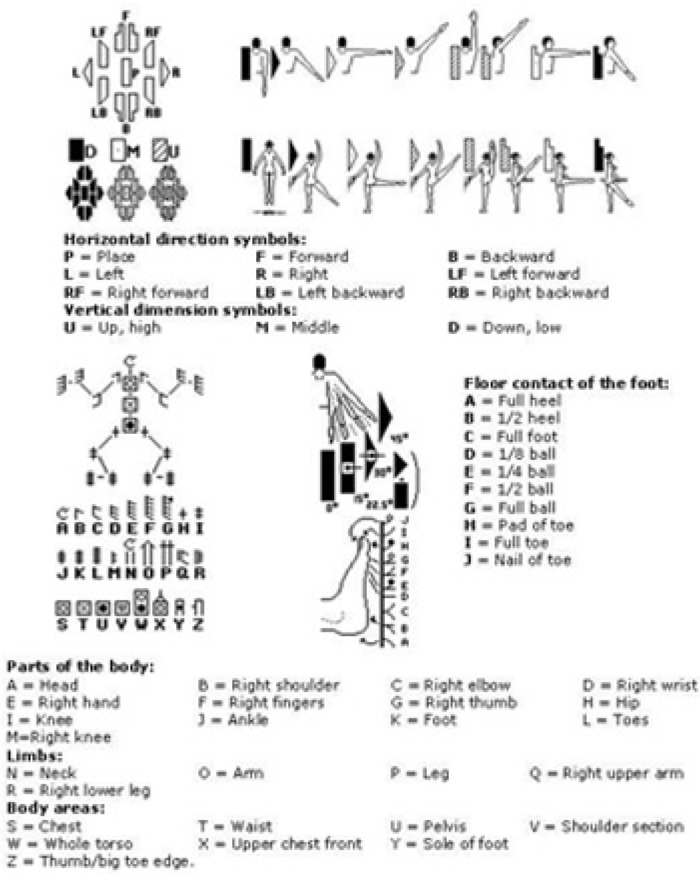

Figure 3: Composite of Labanotation (Griesbeck, 1996)

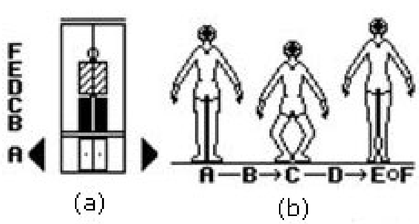

Figure 4: Three basic dance positions (Griesbeck, 1996)

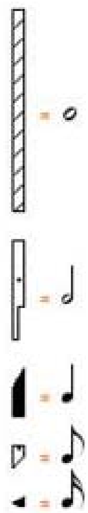

Figure 5: Labanotation versus musical notation (Griesbeck, 1996)

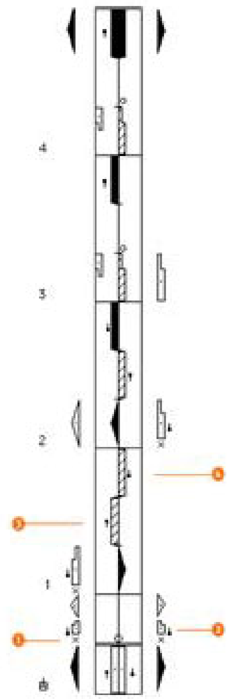

Figure 6: Four measures of ballet in Labanotation (Griesbeck, 1996)

The Sutton Dance Writing Method

"Sutton Dance Writing is a new, international notation system similar to music notation. Just as music uses notes on a five-lined staff to record sound, Sutton Dance Writing records choreography on a five-lined staff (Sutton, 2002)." This notation system was invented by Valerie Sutton and first published in 1973. It is a hieroglyphic system, which moves stick figures across a page like caricatures, creating an animation-like sense of movement (see Figure 7). Each line on the staff corresponds to a specific height of the dancer with respect to the floor. The bottom line depicts the feet, second line the knees, third line the hips, fourth line the shoulders and the top line depicts head height. As shown in Figure 8, this notation system combines the abstract dance movements with the visual by placing animations on the staff. A different perspective is provided by symbols below the stick figure drawings, showing the overhead view as if looking down on top of the head (upper row of circles), and seeing the limbs projecting in various positions (lower row of circles) (Sutton, 2002).

The Sutton Method is intuitive and easy to learn. A novice can look at a score and have a general idea of the movements. Figure 9 depicts the movement across the stage (represented by the square on the left of the staff), body movements (including the direction the dancer faces), feet placement and the tempo of the dance (represented by "1 & 2 &") (Sutton, 1983).

Dancers find The Sutton Method easier, and many academic dance programs are now teaching this method. This notation system gives as much information as the more difficult Labanotation, but many people are more comfortable working within the more graphic Sutton Method.

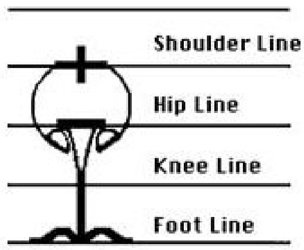

Figure 7: Basic Sutton Method staff (Sutton, 2002)

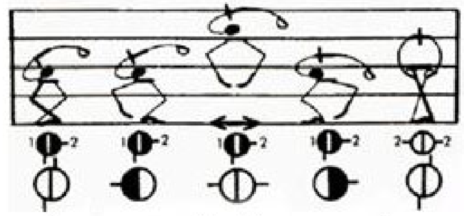

Figure 8: Basic ballet move using Sutton Method (Sutton, 2002)

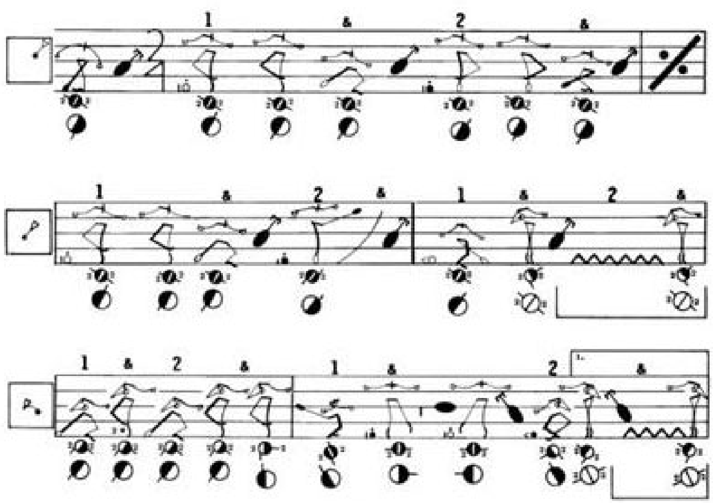

Figure 9: Three measures of a ballet in Sutton Method (Sutton, 2002)

Notation Summary

The comparison of these two notation systems provides important insights that instructional technologists should find interesting. These insights relate to the dimensions on which notation systems vary and criteria for which a new notation system can be chosen or constructed. We believe these principles apply to notation systems in general and definitely to ones for instructional technology. We want to emphasize one of those dimensions that appears to have the greatest implications for the widespread adoption of notation systems; we call this the intuitive versus non-intuitive dimension. The most striking contrast between the Laban and Sutton notation systems is the clear resemblance between the Sutton notation system and the dancers' mental model of a dance compared to the almost complete lack of resemblance for the Laban notation system.

A notation system, like Sutton Notation system, can use diagrams to approximate what a person sees with their eyes, and therefore, to what a person might imagine while designing. The Labanotation system is the equivalent of a different language from our natural visual language, which doesn't look anything like the final product. It doesn't look anything like the experience that is created and envisioned by the designer. So the first lesson from the comparison of these two notation systems is that a notation system will, to some degree, match the experience that it is intended to represent, and the designer's mental image of it, thus facilitating comprehension and eliminating needless mental translations.

Examples of notation systems that look like what they are intended to represent are blueprints and drawings of the physical structures that are used by architects and those with whom they work. In chemistry, multiple notation systems have been invented to capture and represent chemical composition and structure. In organic chemistry there are four notation systems that serve different purposes: some of them very useful for designers of new compounds and some of them almost entirely useless in design. There is, first of all, the verbal expression of the chemical name such as, sucrose. This notation has no inherent clues as to the composition and structure of the chemical itself. A second chemical notation system gives the atomic number of different elements such as, $C_{12}H_{22}O_{11}$, without showing the structural arrangement of the atoms. This requires less translation than the first example. A third chemical notation system is graphic and uses geometric drawings mixed with textual symbols to denote its benzene rings, chains, and other physical structures (see Figure 10) (Oregon State University, 2003). In this system, there are rules for drawing specific kinds of structures, and once again certain geometric information is gained and a certain amount of information lost, for example, the specific name of the chemical. Finally, there is a notation system which uses atom spheres fastened together in a 3-D configuration (see Figure 11) (Indigo Instruments, 2002). The kinds of information that are available in these models include realism relative to the physical proportions of the atoms and possible chemical reaction sites. The computer can model chemicals and some of their behavior using this kind of notation. Working with such visible models backed up by a computer model gives the chemist a working shape of the atoms as well as information related to specific charges and reactions to other chemicals. And so the atomic model representation invites chemists to use this in design and invites them to contemplate what might happen if a reaction were to occur at a certain point. This is a relevant part of protein chemistry today.

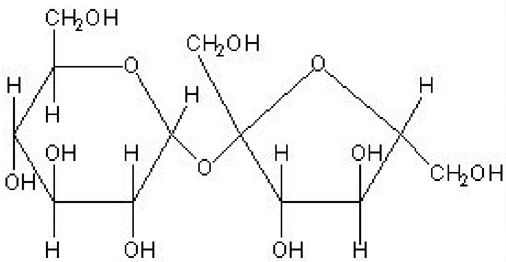

Figure 10: Sucrose composition
(Oregon State University, 2003)

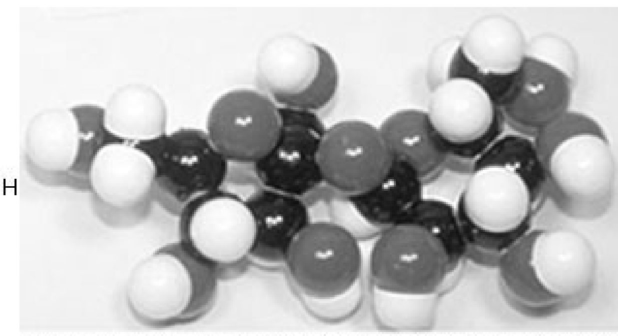

Figure 11: Sucrose model (Indigo Instruments, 2002)

We conclude from this example that notation systems can be related to phenomenal models and perhaps treated as simplified versions of them, thereby, making them intuitive. At the same time, a notation system can be computable as well as resembling the imagined reality.

Dimensions of a notation system

While reviewing the notation systems for dance we began to notice patterns that allowed useful comparisons between systems. We also reviewed additional notation systems in other disciplines including those used in chemistry, architecture, and instructional technology and came up with some suggested general categories for comparing notation systems. These can be considered dimensions along which notation systems vary.

1. *Intuitive versus non-intuitive.* Intuitiveness resulting from visual similarity to mental images, as discussed above, is one of the most important aspects promoting ready usefulness. An example of an intuitive notation system would include the blueprints used by architects and those who work on creating buildings. When a novice looks at the floor plan, they have a general idea of the basic layout of the house that it represents. Even a novice will know that the dining room is adjacent to the kitchen and that there will be a walk-in pantry connected to the kitchen. The foundation portion of a blueprint, on the other hand, is intuitive only to those who are experienced in seeing foundations before houses are placed on them. The average homeowner has trouble visualizing this seldom seen, but essential element of the house design.
2. *Complex versus simple.* A complex notation system, like Chinese writing, has a steep learning curve. With a notation system including 50,000 characters, only about 5,000 characters are in common use. A newcomer to Chinese would spend countless hours acquiring the knowledge of speaking and writing skills to be able to thrive in Chinese speaking communities. In contrast, a simple notation system could be found in highway signage found within the United States. The *Exit* sign is easy to recognize in any state.
3. Computable versus non-computable. The symbols of a computable notation system can be used by computers or other computational means to extend, modify, and execute designed actions or structures. An appropriate combination of computer software and a midi interface can translate traditional musical

notation into musical performance. It is possible to play a piece of music on a keyboard connected to a computer and have the computer not only record the piece digitally, but also record the notation and make it available for editing and distribution. Written English used to be a non-computable notation system. However, recent advances in software make it possible to speak English into a voice dictation system and then take the typed output and feed it into a text reading system which reproduces (usually at lower fidelity) most of the original voice patterns. (This imperfect correspondence between abstraction and public language only emphasizes the value of considering notation apart from abstract design languages.) Most notation systems are not computable, but notation system designers should realize the potential power of computability and consider it as they invent notation systems.

4. *Precise versus imprecise.* A precise notation system is exemplified by the organic chemistry notation given before. An imprecise notation system is exemplified by the recording of foreign names and sounds in English, particularly when the foreign language uses a different character set, e.g. Cyrillic, Hebrew, Chinese, or Japanese, etc. Since there are no rules for the capture of foreign language syllables in English, notations of them vary widely in literature and news reporting.
5. *Rapid recording versus slow recording.* Notation systems are especially instrumental in capturing events while they happen or during design. The Sutton system, because it involves drawings, and since the drawings resemble the visual scene allows for rapid notation and a recorder can get much, if not all, of a dance recorded while it is being performed. Even if minor details of a dance can't be captured rapidly this way, the properties of the Sutton system allow major pivotal points to be captured and details to be filled in later. This quality of this notation system compliments the rhythm of the design recording process, allowing major features to be recorded rapidly and minor details to be added later. This is a design metaphor resembling the "tweening" metaphor used in animation systems. Details tweened can include minor movements, nuances, and emotion and mood content (see #11 below). Several factors contribute to a slow-recording notation system: non-intuitive shapes and symbols, complex constructions, and large and intricate sets of notation symbols. Egyptian and Mayan hieroglyphic notation systems are examples of this.
6. *Resembles the sensory event versus does not resemble the sensory event.* When an element of a notation system resembles sensory elements of the experience being designed, then fewer mental translations are required during both capture and execution of the design. A notation system that exemplifies this is the storyboarding process of making an animated film. Storyboards give enough of an overview so that newcomers to the project will be able to look at the "snapshots" and get a general idea of the storyline. The more a notation system resembles the actual event the less room the person using the notation has for personal interpretations. Labanotation is an example of a system that does not resemble the event it depicts. The dance notation in no way resembles what the choreographer sees in his/her mind. Although with study the notation system can be interpreted to produce the intended dance, a novice would not find the system to resemble the event and many mental translations are required.
7. *Support for improvisation versus no support for improvisation.* Some notation systems anticipate some degree of improvisation, that is, they omit some portion of an otherwise detailed notation. In Handel's Oratorio works, small notations above the musical staff indicate points for the soloist to "have at it" for as long as they choose, in improvising additional non-annotated notes. Another example of a notation that supports (or encourages improvisation) is jazz. Jazz notation includes the basics of the song; the improvised parts are not included. Measures are left for use by various soloists, but the solos are not written out and in many cases not rehearsed beforehand. A notation system that offers little or no support for improvisation includes mathematics.
8. *Interpretable versus non-interpretable.* Interpretation is the act of varying a performance from the exact specifications of the noted design particularly by applying values not constrained by the designer in the notation. An example of a notation system that is interpretable is the Sutton Dance method of recording dance. The system offers caricatures that give an outline of the performance. The system allows for some interpretation by the dancer and allows the choreographer, dancer, director, and others to add their own subtle changes to the score in order to present their own intended meaning. An example of a notation system that is non-interpretable is a blueprint for a precision artifact of any kind. Manufacture of an airplane hydraulic actuator, the pistons that move the airplane's control surfaces, are considered completely authoritative. Any interpretations added to the noted design by a machinist would be severely reprimanded.
9. *Representative of roles versus not representative of roles.* A musical score, a play script, the choreographic plan for a ballet, and (we may speculate) and instructional design, frequently notate their designs for the production roles taken by multiple separate team members. Not only must such notations show individual parts of a performance/artifact manufacture, but they must also show the synchronization of those parts.

10. *Context aware versus non-context aware.* In some cases, design notation must indicate the correlation between multiple art forms or technology forms. For instance, a dance notation must show correlation with the orchestral score. Instructional technology designs also must sometimes show coordination with other ongoing design activities. A company that wishes to integrate training events and activities with normal workflow must show how workflow and training events correlate.
11. *Inclusion of emotional content & mood versus no inclusion of emotional content.* One notation system that includes emotional content and mood is sign language. People express anger, sadness, joy, love, and other emotions through sign language, and the notation system used in training manuals for sign language often includes notations of emotional content and mood shown by facial expression or body motion. Musical scores also posses an entire subgroup of symbols describing the degree of passion a performer should exhibit while playing a particular passage.

State-of-the-art of design languages and notation systems in instructional technology

Instructional designers currently use a great variety of non-standard notation conventions to communicate their designs: flowcharts, storyboard forms, scripts, diagrams, sketches, and text descriptions. But there is little standardization among or between these conventions. This situation is analogous to that during the formative period of western musical notations. Crosby (1997) describes the evolution of musical notation from 900 A.D. to 1300 A.D. He tells the story of the invention of numerous idiosyncratic systems that varied the number of staff lines, the shapes of musical notes, the representation of timing, and correspondence with some portions of the performance. Over time, the best features of these have been retained in the notation system in common use today. This does not mean that there are not still alternative notation systems, for there are many normally used for experimental musical ideas.

We believe a similar notation convention can emerge for instructional designers, but it may be many years or even decades before this happens. One force that may hasten this process, making it shorter than that for music, is the computer, particularly the tool of semantically oriented mark-up languages like XML and its many descendants.

Some volume-production design systems create categories of message or strategy elements that give structure to form-based approaches (Horn, 1974; Merrill, 1983). However these systems focus mainly on a particular layer of a design (Horn: content structures; Merrill: strategy structures) and do not approach the completeness of a blueprint system.

Instructional technologists may look to other fields such as chip design, or computer programming designs where notation systems have moved to a higher level of sophistication (Miller, 2002). Notation systems in these areas have matured from sketch-edged to straight-edged. In these fields there has also grown up a shared terminology and standard context for the sharing of designs. Whereas, blueprints used to be printed on very large paper, 3-dimensional airplane and automobile designs are now displayed on computer screens (Petroski, 1998; Rifkin, 2002; Sabbagh, 1996). The complexity possible in designs in these areas has increased greatly, and greater variations in design are possible because these designs are expressed in languages and notation systems that are compatible. The speed of designs and the transfer of designs directly to manufacture have been greatly facilitated.

Perhaps the most important outcome of a focus on design notation systems will be a focus also on the design languages that underlie them. Design languages are implicit in every design field. For instructional designers they relate to rules and principles for the generation of instructional experiences: “These rules…are the rules of an instructional grammar. Eventually we should develop generative grammars for instruction”(Stolurow, 1969).

Through attention to design languages, and their related notations systems, designers can approach designs with more versatile and precise tools. Moreover, a medium of expression, comparisons, and evaluations of designs is opened. “A design language is like a natural language, both in its communicative function and in its structure as an evolving system of elements and relationships among those elements” (Winograd, 1996).

If a language is what people use for communicating information and ideas to each other, then a design language is what designers use to communicate designs, plans, and intentions to each other. Further research into design structure, design languages, and design notation systems will better equip designers to create powerful, more precise designs.

Summary

Instructional technologists should be interested in notation systems because design involves more than one person. Notation systems capture designs to be reviewed, modified, maintained, and built by someone besides the designer. Given a common language for design, the process of communicating is less complicated and easier to understand by all those involved in the design.

This paper illustrates a number of dimensions that can help designers form their design languages and select the characteristics of their notation systems. It is certain that even with a limited vision of design languages and notation systems, great variation can emerge, testing many alternative approaches to publicizing designs. From this abundance of ideas we expect that notation standards for instructional designs can emerge just as did those for music and that we will discover that the complexities of instruction can be represented in terms of a modest set of powerful primitives.

Within the field of instructional technology we must begin to ask questions about the usefulness of notation systems. As in the example of dance productions it is impossible that one person posses the needed design skills in all of the aforementioned areas. It is our assertion that if we adopt a common notation system or language, we will be better equipped to deal with publishing instructional designs into the common work space which will allow better communication with others of the instructional design team including programmers, graphic designers and other instructional designers.

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An Integration of Situated Cognition and Interaction Theory in Designing Web-based Learning Environments

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Abstract

Building learning environments that create and maximize learning opportunities has been a major concern in designing web-based environments. The majority of learning theories guiding web-based learning are based on constructivist principles, which emphasize the role of an active learner. Situated cognition and interaction theory have been highlighted as contributing to a broader understanding of the role of an active learner. The purpose of this paper is to outline how assumptions of situated cognition and interaction theory can be utilized in a constructivist perspective to design web-based environments that promote learning.

Introduction

Web-based learning has been the form of distance education highlighted in recent years. In order to build effective and efficient web-based learning environments for students, researchers have applied various learning theories to practice. Early forms of web-based learning relied on the recreation of course content to a web format using HTML and Hypertext. Such systems focused on information transmittal. However, there is a move toward designing web-based learning environments based on principles of constructivist learning theories.
The most promising constructivist theories are those that integrate principles of situated cognition and interaction theory to promote learning. The purpose of this article is to investigate the possible implications of situated cognition and interaction theory in designing web-based environments and to apply them to the actual development of a web-based learning environment.

Assumptions of Constructivism

Constructivist theory explains learning as an attempt by the learner to build his or her knowledge. Learning should occur in complex, realistic, and relevant environments that support multiple perspectives and the use of multiple modes of representation. Additionally, the learner should engage in social negotiation as an integral part of learning (Driscoll, 2000). In comparison, the learning process in situated cognition focuses on embedded learning in a realistic environment. Moreover, in interaction theory the learning process focuses on social interaction or exchange between two or more people or groups. Therefore, situated cognition and interaction theory can provide valuable suggestions for designing web-based learning environments from a constructivist perspective.

Situated Cognition

In their model of situated cognition, Brown et al. (1989) suggest that meaningful learning is only taking place when it is embedded in the social and physical context within which it will be used. Additional support for situated cognition comes from research in the area of transfer. Transfer is more likely to occur when the individual learner has an opportunity to develop knowledge and skills in an environment that is similar to the one in which he or she will eventually perform (Bassock, 1990). Moreover, Barwise & Perry (1983) argue indexical representation plays a critical role in developing an understanding of an environment, that is, certain items must be present in the environment in order to understand it. For example, they argue it is difficult for a third party to understand a two party conversation when pronouns, which lack immediate representation, are used. Suchman (1987) describes the potential problem of using diagrams in a manual to gain an understanding of how a particular object is put together. From the perspective of situated cognition, it is not only a realistic environment that is of importance, but also the content tool use that occurs in such environments. Working in a realistic environment permits one to gain critical experience with the content tools. Equally important, the content tools found in the environment may influence how a learner thinks about and behaves in that environment. One might argue that these tools of the environment act as indexical representations cueing the learner's potential actions or performances. More simply put, the tools may help structure the activity.

Situated cognition assumes that learning occurs through increased participation in communities of practice. Wenger (1998) explained that knowing is a matter of participating in the pursuit of active engagement with the world; knowledge is developed through the lived practice of the people in a society. These communities of practice can be structured in learning communities or cognitive apprenticeships. The implication for instruction that is suggested by cognitive apprenticeships, learning communities, and anchored instruction is the importance of a situated context for solving complex and realistic problems. This assumption of situated cognition coincides with the constructivist's requirement for realistic and relevant environments. From the viewpoint of instructional designers, it is necessary to design learning environments in which students can participate actively and deal with real problem situations for exposure to multiple representations of the material. This active participation may occur between individuals or between individuals and the tools of their environment. A second learning theory, interaction theory, buttresses the implications gained from the situated cognition perspective.

Interaction Theory

Interaction theory supports the constructivist perspective of the learning process. Learners construct knowledge through social interaction (Vygotsky, 1978). Social interaction provides mediated interpretations of experiences from each student. While individuals perceive and understand the world in different ways, some overlap in understanding may be created. Through this, individuals can learn other points of view and build a complex understanding of the world. Symbolic exchanges like language enable the individual student to achieve a common understanding, create meaning, and internalize as thought external processes (Vygotsky, 1978). These assumptions of interaction theory coincide with the support for multiple perspectives within constructivist theory. Multiple perspectives can provide the grounds for various forms of scaffolding that can maximize learning in the Zone of Proximal development for a given student in a given content area (Vygotsky, 1978). The interaction has to occur among students or between student and expert. However, Vygotsky also argued that tools could also serve as mediators of thought. By manipulating tools in one's environment and using tools as a form of scaffolding for learning, tools possess the potential for helping internalize various forms of thought. Therefore, instructional designers need to consider the use the synchronous chatting, asynchronous e-mail, or bulletin boards as additional tools. From the viewpoint of an instructional designer, it is crucial to design learning environments that promote the sharing of multiple perspectives. What, then, are the implications of these theories to the web-based learning environment?

Designing web-based learning environments based on the implications

The web is a computer network crossing a geographic area, constructing social and cultural communities through a network. Students can construct their own meaning through this space. To achieve the goals of situated cognition, instructional designers need to consider how to provide students with authentic contexts and generate authentic activity in such contexts. This is potentially the greatest challenge to those designing learning environments in a web-based setting. Certain content areas may be more readily adaptable to this form of delivery system, and it is important for an instructional designer to first determine what he or she desires as learning outcomes in his or her students (Rothwell & Kazanas, 2000). Once these learning outcomes have been established it is necessary to list the strategies and tactics that could be used to facilitate the learning outcomes. Based on an analysis of learning outcomes and strategies/tactics, one should then determine which are feasible for a web-based delivery system. While there is no specific algorithm for arriving at this decision, a general approach will take into account the potential strengths of web-based instruction. These include flexibility, content expandability, learner autonomy, and collaborative learning (Jung, 2001). Moreover, web-based instruction offers the ability to structure activities that foster problem solving and higher level thinking skills. Students must apply knowledge and skills to solve problems in the contexts of real practice. Unlike other types of web-based learning such as tutorials, this approach is not a fact-oriented design. It encourages learners to solve authentic problems in which knowledge will be developed and utilized. Moreover, tools related to successful performance in a real world setting should be incorporated into the activity.

If problems support multiple solutions, students may need to work from multiple perspectives when problem solving. Therefore, a second method to generate authentic activity is to provide students the opportunity for collaboration. Collaboration supports a knowledge construction process among learners. Learners can explore, discuss, and integrate different views through the expression of multiple perspectives, reflection, peer review, and feedback. Collaboration could be structured as student and student, student and group, and group and group formats. While the interaction in situated cognition focuses on participation as a member in a community of practice, a second approach, interaction theory, focuses on cognitive development through scaffolding and coaching. The role of instructional designers would be to provide enough complexity of a real-life context and relevant authentic activities. To do this, a variety of resources that do not simplify the problem are needed. For example, students may need access to relevant multiple websites or expert's websites for gathering information, and such tasks should be group-based to encourage collaboration. Additional web-based tools, independent of content tools, are also needed to support their collaboration such as schedules, archives, self-monitoring functions, whiteboards, chatting rooms, etc. To achieve goals of interaction theory, the web can be used to enable social interactions between student-student and student-expert through chatting, e-mail, and bulletin board. These are web tools to support the exchange of individual thought. The tools also provide students the opportunity to assist other students with scaffolding through synchronous and asynchronous communication. Moreover, web-based tools may be developed to pair less knowledgeable learners with more knowledgeable others in order to provide the necessary scaffolding to encourage knowledge construction.

Table 1 *Situated Cognition/Interaction Theory Guidelines for Application*

Situated Cognition/Interaction Theory Guidelines for Application
Decision Points
❑ **E** - In what environmental context will the learner have to ultimately perform? ❑ **K** - What knowledge or skills will be required for optimal performance? ❑ **A** - What activities can be provided to the learner so that he or she can develop the knowledge and skills associated with the intended environmental context?
Analysis of Environmental Context: Potential for Transfer
Describe the relevant participants, activities, goals, and tools associated with the environmental context in which the learner is expected to perform. ❑ Participants: what are the potential roles of the individual? ❑ Tasks: what are the tasks in which student may be involved? ❑ Goals: what are the desired performance outcomes of the context? ❑ Tools: what tools or artifacts may be associated with the environment?
Analysis of Knowledge and Skills: KSA's for Transfer
Describe the relevant knowledge forms and skills associated with performance of the tasks in the environmental context. ❑ Remembering content knowledge (declarative) ❑ Planning ❑ Deriving solutions ❑ Making decisions ❑ Communicating ❑ Developing attitudes Determine if the individual needs to be able to state how he or she performs the skill (either while within or external to the environmental context) or if successful performance is sufficient. This is a potential component of assessment.
Analysis of Instructional Activities: Methods for Transfer
Describe the instructional activities to be used and how they meet the criteria for situated cognition or interaction theory. ❑ Activity allows for collaboration o Between students o Between instructor and students ❑ Instructor models thinking processes o Instructor provides verbal descriptions of thinking processes o Instructor relates thinking to contextual circumstances ❑ Activity context closely approximates actual environmental context

- Students provide activity/environmental context
- Instructor provides activity context
  - Simple: Instructor provides clear interpretation.
  - Complex: Instructor requires students to develop an interpretation of the context, ensuring students possess relevant prior knowledge.

- ❑ Activity incorporates contextually relevant tools
  - Tools are shared as a group
  - Tools are held individually
- ❑ Activity allows students to practice skills
  - Students practice skills in a collaborative setting
  - Activity requires students to verbalize practice

Despite the fact that the web affords possible ways to accomplish the assumptions of these two theories, one must continue to examine how real world contexts may be represented according to situated cognition and to consider types of interaction needed to manifest the assumptions of instructional theory as a instructional designer.

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Situated Cognition/Interaction Theory
Guidelines for Application

Decision Points

- **E** - In what environmental context will the learner have to ultimately perform?
- **K** - What knowledge or skills will be required for optimal performance?
- **A** - What activities can be provided to the learner so that he or she can develop the knowledge and skills associated with the intended environmental context?
-

Analysis of Environmental Context: Potential for Transfer

Describe the relevant participants, activities, goals, and tools associated with the environmental context in which the learner is expected to perform.

- Participants: what are the potential roles of the individual?
- Tasks: what are the tasks in which student may be involved?
- Goals: what are the desired performance outcomes of the context?
- Tools: what tools or artifacts may be associated with the environment?

Analysis of Knowledge and Skills: KSA's for Transfer

Describe the relevant knowledge forms and skills associated with performance of the tasks in the environmental context.

- Remembering content knowledge (declarative)
- Planning
- Deriving solutions
- Making decisions
- Communicating
- Developing attitudes

Determine if the individual needs to be able to state how he or she performs the skill (either while within or external to the environmental context) or if successful performance is sufficient. This is a potential component of assessment.

Analysis of Instructional Activities: Methods for Transfer

Describe the instructional activities to be used and how they meet the criteria for situated cognition or interaction theory.

- Activity allows for collaboration
  - Between students
  - Between instructor and students
- Instructor models thinking processes
  - Instructor provides verbal descriptions of thinking processes
  - Instructor relates thinking to contextual circumstances
- Activity context closely approximates actual environmental context
  - Students provide activity/environmental context
  - Instructor provides activity context
    - Simple: Instructor provides clear interpretation.
    - Complex: Instructor requires students to develop an interpretation of the context, ensuring students possess relevant prior knowledge.
- Activity incorporates contextually relevant tools
  - Tools are shared as a group
  - Tools are held individually
- Activity allows students to practice skills
  - Students practice skills in a collaborative setting
  - Activity requires students to verbalize practice

Using Bloom's Taxonomy to Determine the Academic Level of Learning Objectives

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Abstract

This author proposes an extension to Bloom's taxonomy in order to more accurately differentiate between undergraduate- and graduate-level learning objectives. The extension proposed is a categorization of conditions present during the performance of skills specified in learning objectives. Bloom's taxonomy and the proposed condition categories will form an x-y axis; the dissection of this axis will enable a more objective determination of the academic level of learning objectives.

Using Bloom's Taxonomy to Determine the Academic Level of Learning Objectives

Bloom's taxonomy has been widely recognized by the education community as a standard in the determination of academic rigor since its development by Dr. Benjamin Bloom and his colleagues during the period 1948 – 1952. The taxonomy consists of six steps, or levels, of student learning ranging from *knowledge* through *evaluation* (Bloom, 1956). While Bloom's taxonomy provides an indication of academic rigor, it has yet to be shown how the taxonomy can be used as a tool to differentiate between undergraduate and graduate learning objectives. In this paper, an extension to Bloom's taxonomy is proposed that will enable more accurate differentiation of the desired outcomes of undergraduate and graduate courses.

The Need

Undergraduate and graduate courses differ primarily in the performances expected of students, rather than the body of knowledge covered. In fact, graduate-level course materials are often indistinguishable from their undergraduate counterparts. Normally, the assignment and assessment items are the tools used to distinguish a course as graduate level. Due to the direct link between learning objectives and assessment, Bloom's taxonomy can be used as a tool for differentiating graduate from undergraduate courses; a certain number or percentage of objectives from different Bloom's levels can be required. For example, at the University of Phoenix it has been determined that 80% of the objectives in graduate courses need to describe skills from levels four, five, and six of Bloom's. Some questions raised by this utilization of Bloom's taxonomy are "who decided on this percentage" and "how did they come to this decision?" There really was no objectively defensible method for assigning these percentages; it was just an arbitrary decision. What is needed is a second dimension to Bloom's Taxonomy that will take the guesswork out of undergraduate/graduate distinction.

Background

Questions regarding the adequacy of Bloom's Taxonomy as a determination of academic level began occurring with the examination of different learning objectives from undergraduate and graduate courses containing the same Bloom's performance verb. The conditions stated in these learning objectives have as much, if not more, impact on the overall academic level of the objectives as the performance verbs themselves. For example, consider the following objective: "The student will calculate the value of a bond." The performance verb for this objective is "calculate;" it is found at level three of Bloom's taxonomy – *application*. At the *application* level, students must be able to apply knowledge or skills to new situations in order to solve problems, answer questions, or perform other tasks (Bloom, 1956). Now, compare the objective stated above with the following *application*-level objective: "The student will calculate the value of a bond during a period of financial instability." This objective clearly calls for the application of a different set of knowledge and skills. However, the Bloom's level of these two objectives is the same; that is, they both describe *application*-level skills. How, then, can Bloom's Taxonomy be useful for determining academic level?

Conditions Categories and Measurement Levels

Learning objectives are traditionally divided into the following three sections: performance, conditions, and criteria (Dick, Carey, & Carey 2001). Performance is indicated by the verb contained in the objective (e.g., demonstrate, explain, compare and contrast). Criteria refers to the accuracy, speed, quality, etc. with which students are required to complete the performance (e.g., with no mistakes, with 50% accuracy, within 5 minutes). Conditions are any materials required to perform the stated task. Conditions in a learning objective may be physical equipment or resources such as a computer, a diagram, a model, etc., or they may be environmental (e.g., during a period of financial instability). As demonstrated by the bond example above, the conditions stated in a learning objective can be very important in determining the academic level of the objective; however, there currently is no method for classifying these conditions in order to utilize them, along with the performance, to determine the academic level of objectives. Next, we will explore the feasibility and ramifications of classifying conditions into general categories and subdividing each category into measurement levels. Table 1 presents the three general categories proposed along with their measurement levels.

	Categories		
Levels	**Resources**	**Information**	**Environment**
	Inclusive resources	Complete information	Static environment
	Missing resources	Incomplete information	Changing environment

Table 1. *Condition Categories and Measurement Levels*

Resources

The resources category represents tools, systems, processes, and equipment required in order for students to perform the skills specified in learning objectives. Resources is the most tangible and easily identified and adjusted of the three categories. Moreover, the lack of resources is arguably easier to accommodate for when performing a task than is lack of information and instability of the environment; therefore, it is the lowest-level category on the proposed scale. It is not necessary, here, to specify which items will be included within the general category of resources; this will be left as general as possible in order to accommodate a wide variety of items and to increase flexibility for the designer. However, some subdivision is needed in order to identify the measurement levels within this category.

The first measurement level within the resources category is inclusive resources. What is meant, here, by inclusive resources is that all the resources required to complete the task will be given to the student. For example, when calculating the value of a bond, the student will be given the necessary formulas and/or methods for performing this task. Because of the “spoon-fed” nature of this measurement level, it is the lowest level within the general category of resources.

The second measurement level of the resources category is missing resources. Missing resources means the student must complete a task without having all of the required tools, systems, etc. For example, when calculating the value of a bond, not every needed formula is provided to the student. This incompleteness of resources requires the student to improvise and make use of critical thinking and decision-making; skills much in demand in the workplace. Due to the real-world nature of this measurement level, it is the highest level within the resources category.

Information

The information category represents knowledge, training, beliefs, and attitudes that students have at their disposal when performing the skills specified in learning objectives. Information, unlike resources, is intangible and difficult to identify and adjust. Furthermore, while performing a task is difficult with missing resources, the difficulty is greater while performing with limited information; therefore, information is at a higher level than resources on the proposed scale. Generally, information is considered to be any data processed and given meaning and/or context; however, as with the resources category, there is no need to specify which items are to be included in the information category (beyond this general definition). Again, as with resources, two measurement levels in the information category are proposed.

The first measurement level within the information category is complete information. What is meant, here, by complete information is that all the information required to complete the task will be given to the student. For example, when calculating the vale of a bond, the student will be given specific information regarding the bond and the procedure for calculating its value. Because the student is merely required to follow instructions in this measurement level, it is the lowest level within the general category of information.

The second measurement level of the information category is incomplete information. Incomplete information means the student must complete a task without being given all the required information. For example, when calculating the vale of a bond, the student is not given all of the operational and procedural information for doing so. This incompleteness of information requires the student to recall and synthesize prior knowledge and beliefs into the performance of the task. Due to the synthesis of prior knowledge involved in this measurement level, it is the highest level within the information category.

Environment

The environment category represents external influences acting upon students when they perform the skills specified in learning objectives. Environment is external to the student, and, for the most part, independent of influence by the student. Furthermore, performing a task in a changing environment is more difficult than with missing resources or incomplete information. Therefore, environment will be considered as the highest-level category on the proposed scale. As with resources and information, there will be two measurement levels within the environment category.

This first measurement level within the environment category is static environment. What is meant by static environment is that the influences acting upon the student are constant during the performance. When calculating the value of a bond, the Federal Interest Rate remaining constant from one period to another would be an example of static environment. Static environment does not require students to adapt for a changing environment; therefore static environment is the lowest level within the environment category.

The second measurement level within the environment category is changing environment. A changing environment, here, is one in which the influences acting upon the student are dynamic; that is, they are changing quickly enough to require adaptation on the part of the student in order to compensate for them. In other words, the outcomes generated by student actions (i.e., the performance objectives) will be significantly altered if no adaptation occurs. Since, arguably, a dynamic environment is the most challenging of our measurement levels, it will be considered the highest of these levels.

The Undergraduate/Graduate Axis

Application

The condition categories and measurement levels developed in the previous section of this paper along with the levels of Bloom's taxonomy form an x-y axis (Figure 1) that can be used to more objectively differentiate between undergraduate- and graduate-level learning objectives. In order to use this axis, the designer will simply plot the point on this axis representing the intersection of the Bloom's and condition levels of the objective. Where this point lies on the axis will indicate whether the objective is undergraduate- or graduate-level.

Use of this axis takes much of the guesswork out of determining whether a course is undergraduate- or graduate-level. Rather than requiring an arbitrarily-assigned percentage of objectives from various levels of Bloom's taxonomy, the designer can require that all of the objectives in a course fall within either the undergraduate or graduate section of the axis, depending upon the intended audience.

Drawbacks

Of course, the use of this axis will not preclude any judgment on the part of the designer. Some subjectivity will still be inherent, at times, in determining the categories and measurement levels under which the conditions stated in learning objectives fall.

Also, judgments will have to be made during situations in which the performance/condition position plots on the line dividing graduate and undergraduate. For example, if the objective contains a performance at the comprehension level of Bloom's and the condition stated indicates incomplete information, then the performance/condition intersection lies directly on the line delineating undergraduate from graduate. In situations of this nature, the designer will have the following two options: make a judgment call, or revise the learning objective.

A third potential difficulty in using this axis arises when learning objectives do not contain explicit conditions statements. While some consider conditions to be a required component of learning objectives, there is disagreement among designers as to the utility or value added to a course by this requirement. However, if no conditions are stated in a learning objective, it can be assumed that the implicit conditions are inclusive resources, complete information, and a static environment. In other words, if no conditions are explicitly stated, then the performance alone will determine the academic level (i.e., Bloom's levels one, two, and three will be undergraduate while levels four, five, and six will denote graduate-level skills).

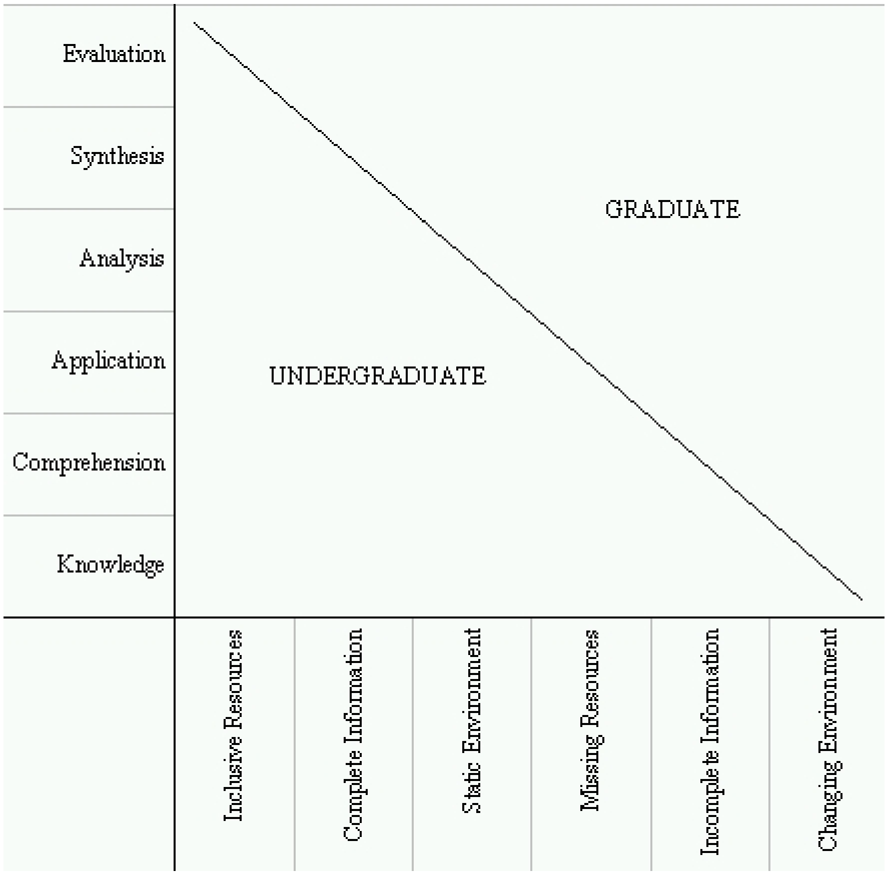

Figure 1. Undergraduate/Graduate Axis

Summary

This paper has introduced a tool for using Bloom's taxonomy to more objectively differentiate between undergraduate- and graduate-level learning objectives. The tool consists of an x-y axis made up of the levels of Bloom's taxonomy and the conditions stated in learning objectives. While designers using this tool will still need to make judgment calls in some situations, they will at least have some assistance in making these decisions.

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Relationships between Promoting Self-Regulatory Skills And Facilitating Student Interactions in Online Learning Environments

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Abstract

The use of self-regulatory skills (SRS) and student interactions have become as major research issues for successful and effective online learning. The purpose of this study was to investigate the effects of student interactions on promoting student SRS in online learning environments. Research questions are whether design strategies to facilitate student interactions have impacts on promoting the use of student SRS, or vice versa. It was expected that student interactions in the environments could contribute to the acquisition or use of their SRS. 32 college students were taught in online learning environment for 16 hours over 8 weeks. With 2 hours per week, one hour was assigned to students' content learning, and the other one for group discussions, having four members each group. SRS questionnaires were administered before and after online learning. Results from this study showed that embedded SRS strategies and group discussions in online learning environments have a possibility of contributing to the acquisition and use of their SRS. In the light of such findings, instructional design strategies to promote student SRS and to facilitate student interactions in online learning environments were discussed.

Introduction

It is well known that learners are responsible for their own learning. It means that "learning is not something that happens to students; it is something that happens by students"(Zimmerman, 1989, p. 21). To have this happen, it seems to be crucial that students have some extent of their self-regulatory skills (SRS) before learning. However, it is likely that most of public school students or many of college students would not come into learning settings with appropriate skills of regulating their own learning.

Recently, universities are moving more and more towards flexible modes of delivering courses. While high school has traditionally been a face-to-face experience, post secondary education is limited to its contact time and is being increasingly channeled through information and communications technology or Internet resources (Roblyer, & Wiencke, 2003). This fading of close social interactions in college significantly diminishes the regularly mechanisms that ensure students' natural development (McMahon, & Oliver, 2001; Chou, 2003). The lacks of close contact between instructors and learners or among learners prevent learners from developing their self-regulated learning. Lidner and Harris (1993) provided some evidence that self-regulated learning are an important part of academic success for college students. Peverly et al. (2003) showed that college students were not as good as expected at self-regulation. It means that many of college students need self-regulation training. But they had few opportunities to become self-regulated in their secondary school years, and as a result, they have few even if any SRS strategies (Orange, 1999). In particular, it has known that student SRS are required to be successful in online learning (Cennamo, & Ross, 2000; Cho, 2003). Accordingly, it seems that design strategies to promote the acquisition or use of student SRS are main research issues in online learning environments. Also, it is expected that design strategies to facilitate student interactions contribute to promoting acquisition or use of student (MacGregor, & Atkinson, 2002-03; Oliver, Omari, & Herrington, 1998).

Interaction seems to be an important factor in online learning environments as well as in face-to-face learning settings (Dykes, 2001; Hillman et al., 1994; MacGregor, & Atkinson, 2002-03). Especially, it is shown that learner interactions can become a good strategy for building learning environments that entails learners expressing their knowledge, getting feedback and constructing knowledge. More generally, learner interactions in online may be useful in light of pedagogical goals (Craig et al., 2000; Vrasidas, & McIsaac, 1999). Cazden(cited in Dytes, 2001) summarized the cognitive benefits of learner interactions: (1) learners are forced to confront each other; (2) learners can enact complementary roles, provide mutual guidance and support, and can service as scaffolding to help each other accomplish learning tasks that might otherwise be too difficult; (3) learners can find a direct relationship with a real audience from which they can get meaningful feedback; and (4) learners experiment and construct new understanding and ideas in peer discourse setting.

It is important that learners know when they need to ask help and be willing to ask for or to accept assistance from someone in learning settings. Orange(1999) suggests that such self-regulation as asking help, giving feedback, self-monitoring, making elaboration and organization can be taught and that peer models or cooperation can be effective means for teaching self-regulation. Therefore it is expected that student interactions in online learning environments contribute to the acquisition or use of their SRS. More recently, researchers reported that promoting students' SRS is possible by their own efforts such as student interactions or cooperation (Craig et al., 2000; Hartley, 2001; Orange, 1999). If then, it appears significant to investigate the effects of student interactions on promoting the acquisition or use of his/her self-regulatory skills in online learning environments.

The purpose of this study was to investigate the relationship between promoting student interactions and facilitating SRS in online learning environments. In order to explore any relationship between these two, design strategies to embed some components of SRS and student interactions through discussions need to be applied to authentic online learning environments. It is assumed that the degree of promoting the acquisition or use of learner SRS might determine the amount and depth of his/her learning in online learning environments, especially when designing web-based learning environments.

Methods

Participants

32 undergraduate students from one university in Korea participated in the study. Participants were enrolled in a two-credit required course that is Introduction to Educational Technology. There were 8 males and 24 females, all junior students with ages ranging from 21 to 24, respectively. They were divided into 8 groups, and each group has 4 members. They were randomly assigned to each group because they are comparatively familiar with each other to induce their active participation at group discussions

Materials

The course for this study was developed into online learning materials. It was taught under online learning environments. The amount of learning materials is for eight weeks with 2 contact hours per week. Participants logged in on the site and learned the course once a week for 8 weeks. Some of strategy components to promote SRS during learning from online were embedded into the contents of the course.

The learning activities in each lesson were designed to encourage learners to study the materials in online and to enable them to deeply explore a given topic through group discussions every class meeting. The order of the presentation was lesson objectives, outlines, content, summary, preview of the next lesson, and discussion about given topics. There were also five quizzes included in each lesson. Discussion between group members was made for 50 minutes, and then each group submitted its result to the discussion task room in an online environment.

Embedded SRS Strategy Components

Strategies to Promote The Use of SRS

Strategies for promoting learner SRS were embedded into the learning materials. SRS strategy components employed in this study were performance control strategies (self-instruction & self-monitoring), self-efficacy strategies (peer feedbacks & attribution feedbacks), and cognitive strategies (elaboration & organization). These SRS strategies were selected because learners have hardly acquired or comparatively used them less than any other strategies during their learning. The embedded SRS strategies in learning materials are the following:

Performance Control Strategies (Zimmerman, 1998):

(a) Self-instruction: Telling for themselves in mind to memorize major concepts or key principles. Or students learned by reciting important concepts for themselves.

(b) Self-monitoring: Checking out for themselves the results of their own learning activities

Self-efficacy Strategies (Zhang et al., 2001)

(a) Peer feedbacks: Encouraging or praise each other about peer ideas or comments from group discussion, or active participation during discussion.

(b) Attribution feedbacks: Providing effort feedbacks for prior success supports students' perceptions of their progress, sustains motivation, and increases self-efficacy for learning (Schunk, 2001). They were encouraged to give attribution feedbacks to each other during discussion.

Cognitive Strategies (Park, 2000; Cho, 2003):

(a) Elaboration: Paraphrasing with learners' own words, and link new information to what they already know when learning key words or concepts in the text.

(b) Organization: Summarizing the contrast, and developing a table or a figure mentally. They were asked to summarize their learning materials on the provided board.

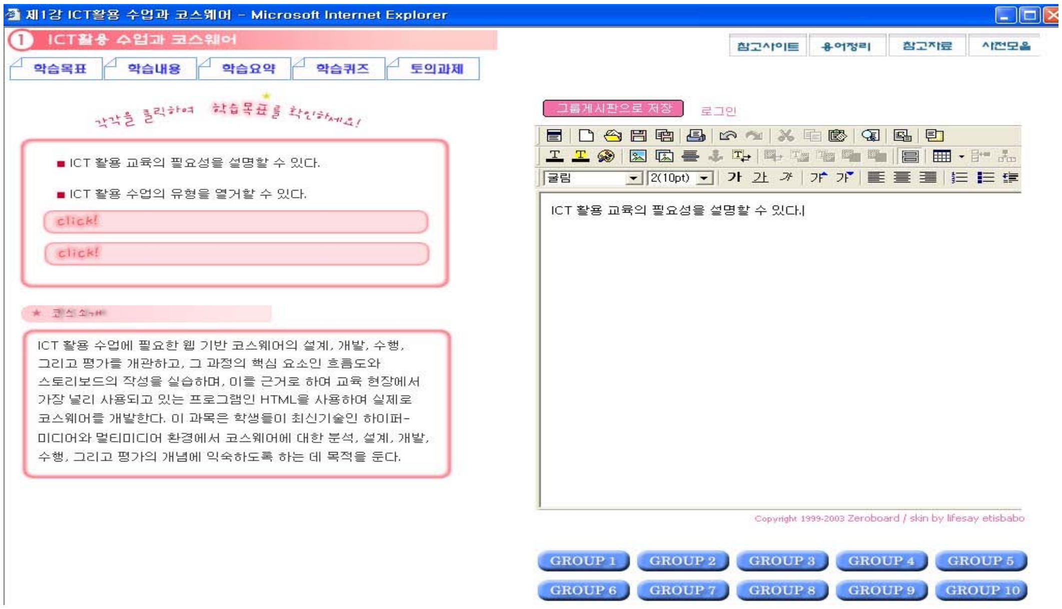

Figure 1 Text screen with embedded SRS strategies

Strategies to Facilitate Student Interactions

(a) It focused on group communications through synchronous discussion. Each group selected one of the given topics through discussion.

(b) Student interactions were performed through discussion to explain and solve the topic selected by the group members for around 50 minutes per week.

(c) Discussion was synchronously made through the MSN messengers in an individual computer screen. Group members logged in after learning the tasks in online.

Group members were encouraged to use attribution feedbacks to each other as often as possible during discussion, for instance, using expressions like "You work very hard!" "You're very knowledgeable on that issue!" when they have good idea during discussion. Also, the use of praise or encouragement words like "good job" or "very well" was encouraged among group members. And feedback examples were exhibited during discussion sessions.

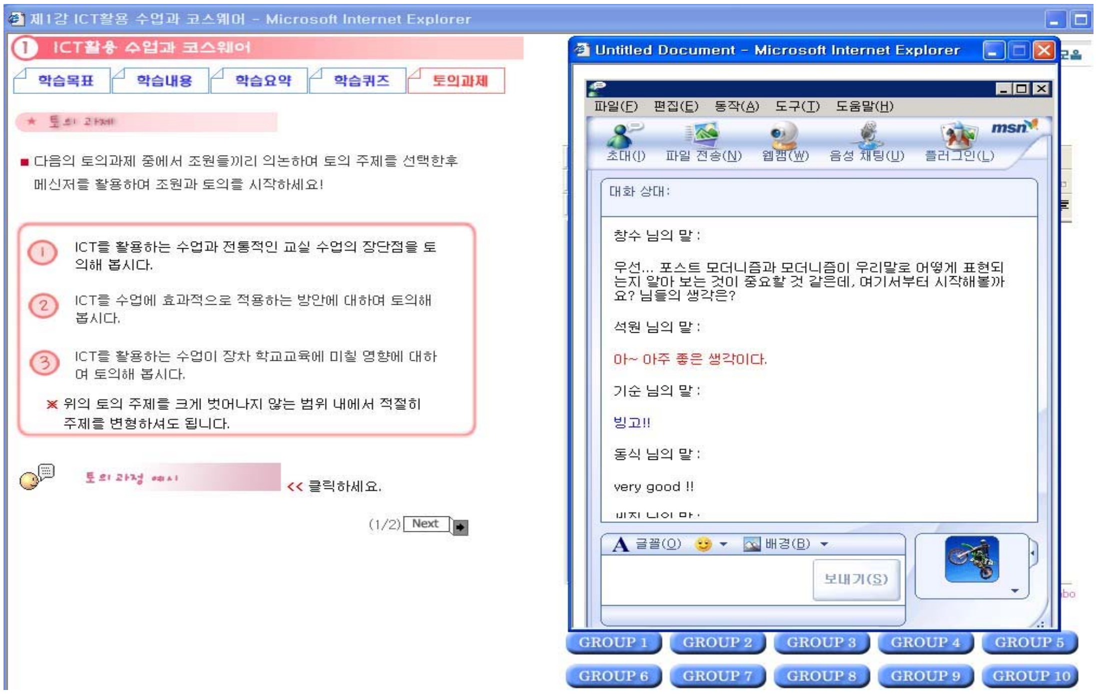

Figure 2. An online discussion screen

Measuring Instruments

SRS questionnaires adapted by Yang (2000) and Park (2000) from the original versions of Zimmerman and Martinez-Pons (1986), and Pintrich and De Groot (1990) were used to measure the acquisition of student SRS before and after online learning. The 84 item self-report measure addressed participants' SRS. Among the 84 items, items of performance control strategies were 14, self-efficacy strategies 11, and cognitive strategies 13. The attitude survey was composed of 15 items, and was administered right after learning. The frequencies and features of interactions between learners and the results of discussion on the given topics were collected.

Research Design

Research design used in this study was pretest-posttest control group design. While this design is one of the experimental designs used extensively when applying new methods or programs in education to instruction, it falls far short of handling the other sources of external validity (Tuckman, 1999). In the present study, the design was adopted because of exploring the effects of online learning programs on the acquisition or use of SRS through student interactions. The independent variables in the study were the embedded SRS strategies and student interactions during online learning and the dependent variables were scores yielded from student SRS measure, and responses to the attitude survey.

Procedures

The study was conducted as a part of students' regular classes for pre-service teachers training. The participants completed the SRS measure as a pretest right before the beginning of the study. They learned the course contents in an online environment for 8 weeks with two contact hours per week. Learning activities were divided into two parts. The first part was the online learning activities and the second was discussion activities among group members about given topics through the MSN messenger. Immediately after an eight-week study schedule, they took the SRS measure as a posttest, and the attitude survey.

Data Analysis

Data yielded from SRS measure were analyzed into mean scores on the pretest and posttest between the experimental and control group. The t-test was used, and the level of α set at .05. Results of the attitude survey were analyzed by contrast with SRS results. And interaction processes by each discussion group were examined.

Results and Discussions

The effects of Embedded SRS Strategy Components

The effects of embedded SRS strategy components and student interactions through discussion on the acquisition or use of SRS were examined in online learning environments. To determine whether there was a difference between the pretest and posttest scores yielded from SRS measure on the experimental group, a t-test was used. As shown in Table 1, the mean difference between pretest scores (M = 3.44, SD = .46) and posttest scores (M = 3.60, SD = .44) in the experimental group was not statistically significant, t (31) = 1.669, p > .05. This means that the use of embedded SRS strategy components and student interactions in online learning environment could not be useful in facilitating the acquisition or use of student SRS in this study.

Table 1 *Means and SD for Scores of embedded-SRS strategy components*

Test	n	M	SD	t	df	p
Pretest	32	3.44	46	1.669	31	.105
Posttest	32	3.60	44			

The Effects of The Whole SRL Measure

Although not statistically significant, the embedded SRS strategies and student interactions in online learning did appear to have substantially positive impact on the acquisition or use of student SRS as compared to the result of the control group. As shown in Table 2, the mean difference between posttest scores of the experimental and control group (M = 3.60 and 3.57) was far smaller than the mean between pretest and posttest means (M = 3.44 and 3.60) on the experimental group. This means that the use of embedded SRS strategies and student interactions in online learning could contribute to promoting the acquisition or use of student SRS (Cennamo & Ross, 2000; Hartley, 2001; Peverly et al., 2003), or to facilitating student interactions through the use of his/her SRS (Dykes, 2001; Orange, 1999).

Table *2 Means and SD for the total SRS strategy scores by each group*

Group	n	M	SD	t	df	p
Experimental	32	3.57	.44	.419	65	.677
Control	35	3.53	.37			

The Results by Each of the Embedded SRS Strategy Components

It appears that the results were mainly yielded from group discussions in online learning because the mean difference between pretest scores and posttest scores for performance control strategies was larger than other embedded SRS strategy components (see Table 3). This means that interactions among students might be an important factor influencing the acquisition or use of SRS strategies. When they discussed about a topic with group members through online MSN messengers, 78% of participants (32) said that student interactions were useful to promoting self-monitoring during learning. Although both the use of self-efficacy strategies and cognitive strategies were improved during online learning and student interactions, none of them was statistically significant in the degree of improvement.

Table 3 *Means and SD by each of embedded SRS strategy components in online learning*

		Pretest		Posttest	
	n	M	SD	M	SD
Performance Control Strategies (Self-instruction & self-monitoring)	32	3.36	.67	3.59	.59
Self-Efficacy Strategies (Peer feedbacks: immediate and attribution)	32	3.34	.49	3.47	.48

Cognitive Strategies (Elaboration & organization)	32	3.47	.55	3.67	.54

Relationships of SRS Strategies and Student Interactions in Online Learning

On the other hand, the mean scores of the whole SRS strategies on the pretest and posttest of the experimental group are likely to show that the possibility of facilitating student SRS strategies through group interactions in online learning is much higher. That is, the mean scores of the whole SRS strategies on the pretest and posttest were further lower than mean differences on the acquisition or use of embedded SRS strategies on the experimental and control group (see Table 1 and Table 4). This suggests that student interactions through discussions among group members through the MSN messengers (student interactions) could influence promoting the use of student SRS strategies (McMahon, & & Oliver, 2001; Zhang et al., 2001), or that the acquisition or use of student SRS strategies might have an impact on facilitating student interactions in online learning.

Table 4 *Means and SD for the whole SRS on the experimental group*

Test	n	M	SD	t	df	p
Pretest	32	3.51	.40	.630	31	.533
Posttest	32	3.57	.41			

However, it is recognized that this study had several limitations, which could not gain more positive impact on the acquisition or use of student SRS strategies in this study. For instance, the study had comparatively short periods in online learning (McMahon & Oliver, 2001), an inappropriateness of embedded SRS strategies design (Cennamo & Ross, 2000), and the weak validity of SRS questionnaire to be measured in online learning (Orange, 1999). However, the results of the present study suggest that the acquisition or use of student SRS strategies in online learning environments can be facilitated through embedded strategies in lesson materials and student interactions using synchronous discussions. Further research on promoting the use of student SRS or facilitating student interactions is required to examine the effectiveness of each components of self-regulatory skills in online learning environments.

Conclusions

This study was conducted to investigate the effects of embedded self-regulatory skills strategies and student interactions through group discussions in online learning environments. The results from this study showed that the embedded SRS of performance control strategies, self-efficacy strategies, and cognitive strategies did not influence the acquisition or use of student SRS in online learning. Those strategies suggest that when compared to the whole SRS strategies, however, they could promote using student SRS. This means that promoting the use of SRS might be facilitated by student interactions through online group discussions. This study seems to have some implications for providing a possibility of exploring relationships between promoting SRS and facilitating student interactions which are necessary in designing and developing an effective online learning environment.

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The Application of Instructional Design at the University

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Abstract

Instructional technology can be applied in any setting where there is a need to improve performance and understanding. Because of historical and cultural traditions, universities do not typically apply instructional technology. This transition would require that faculty be trained in the various facets of instruction, or else a team-approach to the design and development of instruction must be applied. Recommendations for the application of instructional design at the university include any combination of the following: a clear definition of the functions and roles of the university and its personnel, new looks at faculty development efforts, a redefinition of the college classroom, and a change in faculty roles. These types of changes will allow universities to produce high quality learning experiences.

Introduction

In a recent meeting of university faculty, an administrator stood and explained that the university setting we are used to no longer exists. A fundamental change is that students (and their parents) are requiring more accountability of the university they choose to attend (and to which they give thousands of dollars each year). The climate is changing such that students are becoming more critical education consumers, requiring that the university they choose provide them with a certain level of knowledge and skill in exchange for their tuition money.

This same university was recently reclassified and restructured from a junior college into a bachelor's degree granting university. In the process of this transition, the board of directors for the new university stressed that "effective teaching and advising will be the primary responsibilities of its faculty, who are committed to academic excellence" (2000).

Faculty at institutions of higher education are required to wear multiple hats which require that they be a professional subject matter expert, instructional designer, instructional developer and instructor. Principles of instructional design and the scholarship of learning and teaching often become secondary to research in the subject matter, and "teaching the way I was taught" becomes the standard.

Improved teaching and learning at the university can occur by identifying specific roles and functions in the instructional design process and applying researched principles of sound instruction to each of these functions. This can occur in a number of ways including compensation restructuring, focused faculty development efforts, maximizing delivery media, and redefining faculty functions.

Background and Context

Some brief definitions will provide context for understanding the application of instructional design at the university:

- Instructional Science -- "Instructional <u>science</u> is concerned with the discovery of the *natural principles* involved in instructional strategies . . . which nature will reveal as a result of careful scientific inquiry" (Merrill, Drake, Lacy & Pratt, 1996).

- Instruction Design -- "Instructional <u>design</u> is a *technology* which incorporates known and verified learning strategies into instructional experiences which make the acquisition of knowledge and skill more efficient, effective, and appealing" (Merrill, Drake, Lacy & Pratt, 1996).

- Instructional Technology -- Using the definitions of instructional science and instructional design as a basis, we can define instructional technology as the application of the principles discovered through the science of instruction, or, instructional design in action. The Commission on Instructional Technology defines instructional technology as "a systematic way of designing, carrying out, and evaluating the total process of human learning and communications, and employing a combination of human and nonhuman resources to bring about more effective instruction" (Commission on Instructional Technology, 1970).

In theory, instructional design would be found in practice in any place where there is a need for people to change or to gain knowledge or skills. Since they are defined by science, these principles of instruction should be universally applicable in any setting where instruction occurs. In the corporate environment and in automated instructional environments, instruction is commonly designed according to established principles of effective instruction. In general, instructional design is most commonly applied in areas where instruction involves a team approach. For the team to be effective, even for the team to be able to operate, there must be a design document in place.

Due to a number of factors, including the history and tradition of universities and the relatively new and just emerging nature of the field of instructional science and instructional technology, instructional design is not typically applied in the university setting.

The primary functions of today's universities are threefold: research, teaching, and public service. The purpose of research is to identify true principles or laws. Research provides a foundation or basis for teaching. A university is a natural setting for teaching because it is typically the home of research. Researchers that double as teachers work to educate and train learners regarding scientifically-proven principles. These students will go on to apply those principles in the workplace. This cycle continues over and over. As true principles come to light through research, the truth is taught to others and then applied in the world (see Figure 1). This is how we function and progress as a society.

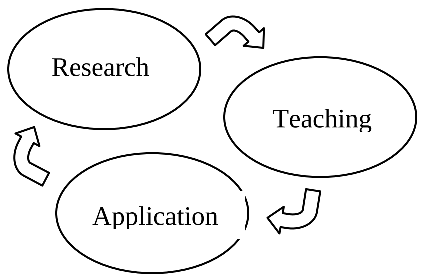

Figure 1: University Cycle

This research-teaching-application cycle functions in all areas, *except within itself*. Teaching and learning is also a field of study, put into practice most often at the university level. Whereas the mountains or valleys are the most common setting of application for research and teaching in the field of Geology, the university is the most common setting of application for research and teaching in the field of Teaching and Learning. However, the research-teaching-application cycle is rarely applied in this setting. Universities are required to fill the essential role of teaching in this progression cycle, yet in doing so they tend to ignore the research on how to teach and learn most effectively. Traditionally, the truth-seeking universities ignore the principles of truth discovered through research in filling their fundamental roles of teaching students and helping them apply true principles in the world. While excelling in the area of research, universities do not sufficiently teach others and help them into a position to apply true principles. Because of the lack of attention to teaching and learning, the university itself corrupts the very cycle that justifies its existence.

An effective learning experience is a work of creation that must be planned first, and then carried out. In my experience as a university student, teacher, and faculty consultant, I've found that the emphasis is commonly on what is being taught and not on how it was being taught. The design of the instruction is carried out haphazardly or on the spot. Good or not, educational experiences will occur as learners interact with each other, teachers, and specific subject matter. The effectiveness of those experiences will be greater if they are planned for and designed in advance.

Instructional Technology at the University

If the teaching and learning process is still a major component in the cycle that defines the university, then more attention must be paid to applying the research done on teaching and learning in the university setting. Whether we define the individual components of this education and training as lessons, units, modules, classes, or something else, there is a significant amount of instruction (intentional and non-intentional) that takes place as one of the foundational purposes of the university. The better this instruction is designed the more effective it will be.

Faculty members at most universities are given the challenge of filling various roles in the instruction process. They must be the subject matter expert, the instructional designer, the instructor, the instructional developer, and the instructional evaluator. Most faculty are hired because of their abilities as a subject matter expert (researcher) and most have little experience in filling the other important roles in the instruction process.

If we look at examples from a cross section of university teaching we can see how this is the case. University faculty that are interested in true teaching have always had to wear at least two hats. While wearing one hat the faculty member is an expert in their given discipline. While wearing the other hat the faculty member is an expert in the field of teaching and learning, or instructional design. Given that instructional design is a field of study all its own, teachers need to have a "double-major."

The goal of the instructional designer is to make scientifically-based decisions that make each moment of the learner's interaction with the subject matter deliberate so that the learning experience is effective and efficient. All educational experiences, simple or complex, are composed of different functions. These functions are defined below by the names of the people who would carry out that function.

The Subject Matter Expert—has a clear understanding of the content the learner is seeking to comprehend. This person is commonly the researcher or practitioner.

The Instructor—seeks to help the learner in his quest for understanding of the content.

The Instructional Designer—plans what interactions and experiences will occur between the learner, the content, and the instructor to provide for maximum learning.

The Developer—constructs any physical pieces of the instructional experience required by the design.

The Evaluator—points out areas of the instruction that are incomplete or breakdown in the process of a learner coming to an understanding of the content.

In most university settings, one individual carries out all of these functions. In most cases the faculty member is a subject matter expert in his or her discipline, but not specifically trained as an instructional designer, an instructor, or in any of the other roles that are involved in a successful learning experience. If we compare the instructional team to a football team, the faculty member in the traditional sense is required to play multiple positions – quarterback, running back, linebacker, and defensive end – all at the same time.

There are two approaches to making instruction more effective in the university setting. First is a team approach to instruction where an expert fills each of the roles listed above. This team approach is often used in distance education environments, which require more advanced technologies and more precise advance planning of instruction than is typical in a traditional classroom. This distance education approach can benefit educators in any setting. In arenas outside education, a team of inventors, engineers, and builders combine their unique skills to produce a quality product—i.e. the Pentium processor or the Golden Gate bridge. Within education, a team of instructional designers, subject matter experts, instructors, and developers can also combine their unique skills to provide a quality learning experience for university students. This is an approach to learning that is not common in the university setting. "It seems that in many tertiary institutions, the ratio of instructional designers (IDs) to teaching staff is often around 1 : 100-200. This means that many staff have to grope in the dark on their own even if they need support." (Tan, 2002)

The second approach to making instruction more effective requires the college instructor to be multi-talented. The educational roles and functions listed above are still met, but by only one individual. In addition to the formal training already received (i.e. Physics or Sociology), the instructor must gain the skills to fill each of the instructional roles. In any educational experience, each of these functions is carried out, deliberately or not. Effective instruction occurs when each of the functions is carried out with deliberation, care, and skill.

Instructional Design happens at a number of levels at the university. The global level is university- or college-wide, often called program or systems design. The design happens at the local level for a specific class, or unit, or module. For it to be effective, some element of design should exist at the macro as well as the micro level, which would include semester design, daily class design, and others.

Instructional design is most frequently applied and researched in areas of "automated" instruction, or technology-enhanced instruction, like simulations or other computer-aided instruction, where the dynamic element of a live teacher is not present. Instructional design is least often intentionally applied when the dynamic teacher has control over all elements of the instruction. This view (and current practice) has the teacher filling all of the roles in the design and development of instruction, not by design but by default. Because the teacher plays such a foundational role in the whole instructional process at the university, it may help to analyze the role of the teacher.

Historically, either by necessity or because of ignorance to the science of instruction, teachers have been required to fill all instructional roles. Education has become centered around the teacher. This tradition has been carried on. The opposite view is that no teacher is necessary. There is much instruction that takes place with little or no human interaction or interference. History has shown that hybrid models are the best. This is instruction that combines the best elements of face-to-face instruction with the best elements of automated instruction. This type of setting allows the teacher to do what they can uniquely do as a human, and letting the other parts of the instruction happen automatically.

In the early days of instructional science, B. F. Skinner said: “There would be no point in urging these objections if improvement were impossible. But the advances which have recently been made in our control of the learning process suggest a thorough revision of classroom practices and, fortunately, they tell us how the revision can be brought about. . . .

“The modern classroom does not, however, offer much evidence that research in the field of learning has been respected or used. . . In the light of our increasing knowledge of the learning process we should, instead, insist upon dealing with those realities and forcing a substantial change in them.

“Education is perhaps the most important branch of scientific technology. It deeply affects the lives of all of us. We can no longer allow the exigencies of a practical situation to suppress the tremendous improvements which are within reach. The practical situation must be changed.

“There is a simple job to be done. The task can be stated in concrete terms. The necessary techniques are known. The equipment needed can easily be provided. Nothing stands in the way but cultural inertia. But what is more characteristic of America than an unwillingness to accept the traditional as inevitable? We are on the threshold of an exciting and revolutionary period, in which the scientific study of man will be put to work in man’s best interests.

“Education must play its part. It must accept the fact that a sweeping revision of educational practices is possible and inevitable. When it has done this, we may look forward with confidence to a school system which is aware of the nature of its tasks, secure in its methods, and generously supported by the informed and effective citizens whom education itself will create” (Skinner, 1954).

Into Practice: From Here to There

This statement of B.F. Skinner was made in 1954, yet the same fundamental conditions exist in the formal education setting today. It is possible to move from the current system and tradition to a better system, and the transition is already beginning to occur. This transition can only happen through the application of instructional technology at the university.

Define Functions and Roles

In making the transition, a beginning step is to outline the functions and roles or outcomes of the university. A university may determine that one of their necessary functions is to teach students. The individuals responsible for designing and implementing the instruction would be paid according to the success or failure of that goal. If students meet learning objectives the staff gets paid more. If students fail to meet the objectives, the staff gets paid less. This may provide motivation to the teaching staff to pursue proven teaching techniques, or principles of instructional design.

Another recommendation for making the transition to better teaching at the university is to clearly identify and define the roles of the faculty member. Faculty members commonly focus on their role as subject matter experts. By defining their additional roles as instructional designers, instructors, developers, and evaluators, faculty members gain a clearer idea of their potential as teachers. Their job description becomes more complete. This also provides focus for the second recommendation for making the transition, faculty development efforts.

Faculty Development

Faculty development efforts help faculty fill all of the educational roles. Faculty can receive training and consulting in the areas of instructional design, development, and evaluation, including proven teaching techniques and strategies. Because one of the primary purposes of the university is teaching, the language of instructional design must become part of the language of the university faculty member. In addition to the scholarship of Biology, Chemistry, and Literature, faculty members must become versed in the scholarship of Teaching and Learning. As they do this, the traditional teaching methods, which are being proven as less-effective, will be replaced by proven methods of successful instruction. Most universities employ educational technologists that can provide this consulting service. This training will provide an opportunity for faculty members to become scholars of teaching and learning.

Related to this training and consultation is the need to provide resources for faculty to develop their own toolboxes of instructional design principles and proven teaching techniques. Most campuses have faculty development centers that can be a source for these resources. However, these efforts can only be effective if they address the heart of the learning issues and provide opportunities for immediate application. In this scenario, faculty members would assume the various roles in the instructional design and development process (subject matter expert, instructional designer, instructor, developer, etc.), and receive training in these various roles. Faculty tenure and benefits would be tied in to their ability to perform in these various roles.

An extension of this idea involves instructional evaluation. Many universities conduct student evaluations on their courses, but few of these evaluations are used or even intended to improve teaching. Faculty could use course evaluations as a basis for improving teaching, which would lead them to ask the fundamental questions about what makes good teaching. Faculty would be asking those questions that are answered in the instructional technology research. The key would be to align the faculty that are asking the questions with the people or resources that have the answers.

Redefine Classroom

A third recommendation for transitioning from the current state of university teaching to the application of Instructional Design calls for a new and different look at the college "classroom." What is the advantage gained by being together in a room with students? Are there classroom activities that could be carried out more effectively and efficiently online, to provide more time to the unique elements of human interaction? Can faculty utilize other teaching tools to provide focus to their teaching? A valuable element of the university experience is being together in the same place with other people pursuing similar interests. Something unique occurs as individuals are in the same physical space. Individuals can sense things in other individuals allowing them to make comments and judgments influenced by the group dynamic. A common problem with having haphazardly designed instructional experiences is that the mediums get misused. A teacher takes valuable group time to do clerical tasks – i.e., announcements, explaining assignments, or going through rote memory exercises. The real value of the faculty member is wasted. Instructional designers can identify that which is unique to the classroom, and what the faculty member uniquely brings to the learning experience and capitalize on it. "Of course the teacher has a more important function than to say right or wrong. The changes proposed would free her for the effective exercise of that function. Marking a set of papers in arithmetic – 'Yes, nine and six are fifteen, nine and seven are not eighteen' – is beneath the dignity of any intelligent individual. There is more important work to be done – in which the teacher's relations to the pupil cannot be duplicated by a mechanical device. Instrumental help would merely improve these relations…. If the advances which have recently been made in our control of behavior can give the child a genuine competence in reading, writing, spelling, and arithmetic, then the teacher may begin to function, not in lieu of a cheap machine, but through intellectual, cultural, and emotional contacts of that distinctive sort which testify to her status as a human being" (Skinner, 1954).

Changing Faculty Roles

A fourth and final recommendation is to change the role of the faculty member. Rather than requiring the faculty member to fill all the jobs required for effective instruction, this model would make the faculty member solely responsible for what they do best, being the subject matter expert. Other trained professionals would be brought in to do instructional design, instructional development. A professional instructor or facilitator would be employed, along with a professional evaluator. Faculty would play their unique role – while other roles would be played out in other ways.

Conclusion

The culture of higher education is changing. Students have more choices as to how they will receive their education, and are requiring more accountability from those providing the education. Those in the university setting can provide the best possible education by practicing principles of instructional technology.

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Implementing Portfolios As Comprehensive Assessments

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Abstract

The purpose of this study was to analyze how portfolios can be implemented as comprehensive assessments. Portfolios provide today's educators with a viable means of measuring student knowledge within the framework of the life experiences and the values of the learner. Despite the potential that portfolios offer, the intellectual and resource demands of developing a portfolio assessment strategy are immense. Successfully implementing portfolios as comprehensive assessments is complex and involves a myriad of issues. Three specific questions guided this paper:

1. *What factors influence assessment strategies that are multifaceted, collaborative and reflect a comprehensive view of educational progress?*
2. *What factors influence the implementation of a comprehensive portfolio assessment plan?*
3. *How can the portfolio process be effectively managed on an individual and school-wide level?*

Managing and planning the portfolio process is an ongoing process. A long-term commitment to a comprehensive reform plan is needed to ensure success. As part of this long-term commitment the schools specifically need to address the following areas: time and scheduling, roles and responsibility and technology support. When considering portfolio implementation, one must realize that by embracing alternative assessments, educators are beginning rather than ending a complex process. The goal of employing appropriate assessments represents a series of decisions that should be continually questioned and revisited.

Implementing Electronic Portfolios As Comprehensive Assessments

The purpose of this research was to understand the factors associated with implementing portfolios as comprehensive assessments.

The questions guiding this paper are as follows:

1. What factors influence assessment strategies that are multifaceted, collaborative and reflect a comprehensive view of educational progress?
2. What factors influence the implementation of a comprehensive portfolio assessment plan?
3. How can the portfolio process be effectively managed on an individual and school-wide level?

Portfolios as an assessment tool, present educators with an instrument for assessing higher order, complex skills; skills not easily measured on multiple-choice tests. Student involvement in the creation of their portfolio fosters a sense of ownership for their work, setting of their goals and self-evaluation of their progress. Portfolio use as part of classroom activities has been reported by 57% of the teachers in a study conducted by Henke, Chen and Goldman (1999). English and language arts (40% of the teachers in the study) lend themselves more readily to the use of portfolios for assessing student work than do math, science, social studies and other subject areas (25% of the teachers in the study).

Not only does the subject area presently determine the use of portfolios; the grade level of students does as well. The use of portfolios to assess at least one content area occurs in 75% of the reported primary classrooms and 60% of the reported intermediate classrooms. In high school, 41% of the high school teachers reported using portfolios in at least one subject area. As the grade level of students increases, the use of portfolios declines. The use of portfolios to assess student work overall, and specifically in English, language arts and mathematics occurs less among intermediate teachers than among primary teachers (Henke et al., 1999). About 75% of all primary grade teachers and 60 percent of intermediate grade teachers used portfolios to assess skills in at least one content area. In contrast, 41 percent of high school teachers reported using portfolios in at least one subject area. Even within the elementary grades, teachers' use of portfolios declined with the grade level of their students: intermediate teachers were less likely than primary teachers to report using portfolios to assess student work overall and specifically in English/language arts and mathematics (Henke et al., 1999).

Conceptual Framework

Baker, Freeman and Calyton (1990) argue that not having a clear mechanism for evaluating students' complex thinking and problem solving skills impedes our instructional programs and also communicates to teachers, parents and students that these untested skills lack importance. In order to develop comprehensible mechanisms we need to develop clear and consistent working definitions of the terms employed in the assessment process.

The term "authentic" in this study refers to assessments for which there are no pre-specified answer. As Nystrand (1997) states:

> Authentic questions are questions for which the asker has not pre-specified an answer . . . Dialogically, authentic teacher questions signal to students the teacher's interest in what they think and know and not just whether they can report what someone else thinks or has said. (p. 120)

In this paper, assessments looking for one right, pre-specified answer are referred to as traditional assessments. Nystrand (1997) states that:

> By contrast, a *test question* allows students no control over the flow of the discussion . . . a test question allows only one possible right answer, and hence monologic. (p. 120)

With these definitions as our guide we can explore the background of portfolios as comprehensive assessments.

Historical Perspective

The following table provides a historical perspective of how assessment practices have been utilized by various societal and political groups. This timeline begins 2000 B.C. and concludes 4000 years later.

Table 1 *Assessment Timeline*

Year	Significant event
2000 B.C.	Chinese civil service exams were established in a move toward meritocracy and away from unfair preference in choosing civil servants.
400 B.C.	Socrates in Athens, Greece developed conversational methods to assess the positions described and defended rhetorically by students.
1700s	Early U.S. testing involved oral examinations conducted by faculty who use professional judgment to determine the quality of student performances.
1830s	Horace Mann first used written tests in Massachusetts and Connecticut. Mann's 1846 Boston Survey were the first printed tests for large-scale assessment of student achievement in geography, grammar, history, philosophy, astronomy, writing and arithmetic. The Boston School Committee was shocked by perceived low student performance. Because these tests results were not used, the use of the survey was discontinued in 1847.
1895	Joseph Rice conducted testing in a number of large school systems. The results were: (1) negligible differences in spelling scores regardless of amount of instruction time, and (2) large differences in math scores among schools. The recommendation was to develop and utilize standardized examinations.
1900s	Alfred Binet developed tests of general intelligence (g), to identify developmentally disabled children in Paris and to provide them with remedial education. Edward Thorndike devised and promoted objective tests to improve on classroom assessments. The U.S. Army's alpha and beta tests, for literate and illiterate World War I recruits, were used to match personnel to military assignments. By the 1920s, standardized, norm-referenced tests began to be widely implemented.
1933-1941	The Progressive Education Association emphasized the ideas of John Dewey and others regarding individualized, experiential education. Ralph Tyler's Eight-Year Study in 300 colleges and universities of students from 30 high schools associated with progressive education found that the

students outperformed matched peers (n = 1,475) who had been exposed to rigid college-preparatory curricula.

1957 The successful launching of the first satellite, Sputnik I, by the USSR generated intense desire in the United States to outperform Cold War competitors. Political momentum swelled for developing better instructional programs, especially in science and technology, and for comparing educational results internationally.

1965 The Elementary and Secondary Education Act (ESEA) of 1965 was passed, "new math" and other curricular and pedagogical innovations initiated, and educational evaluation established to study the effectiveness of the new programs.

1969 The National Assessment of Educational Progress (NAEP), promoted by Tyler and mandated by Congress, began to chart trends in student achievement using matrix-sampled tests. Directed by the National Center for Educational Statistics (NCES), constructed-response items were included in 1988. In 1990-1991, trial state assessments were first conducted. Federal law named the National Assessment Governing Board (NAGB), a group of representatives of public and educational constituencies, as the NAEP policy-setting body. NAEP increasingly influenced state assessment programs. By 1998, the Educational Testing Service (ETS) and National Computer Systems (NCS) were heavily involved in NAEP.

1970s Standardized, norm-referenced (NRT), minimum competency tests were adopted in many states and districts across the United States. Subsequently, concerns arose about teaching to the minimum, and drop out rates increased.

1980s Use of criterion-referenced tests (CRTs) grew in reaction to problems with NRTs, as did emphasis on educational excellence and higher-order thinking skills. Opposition to standardized testing grew, but so did the public popularity of the tests. Publication of *A Nation at Risk* (National Commission on Excellence in Education, Washington, D.C: Governmental Printing Office) in 1983 ushered in a new round of educational panic and reform fervor, which remained unabated for 15 years. Reform focused not on curricular improvement but on accountability, with aggregated scores on standardized achievement tests as the prime indicator of educational quality.

1990s Testing dominated educational reform despite substantial research documenting problems with standardized tests, including biases, distortion of curriculum, and diversion of resources from instruction to testing. As alternatives to standardized tests, performance assessments were developed locally and by states. In 1989 the National Council of Teachers of Mathematics (NCTM) developed well-received standards, leading to the development of standards in other subjects by other organizations. States moved into standards-based assessment. Conservative opposition, centered on cost and privacy issues, effected retreats from performance assessment in some states.

1994 Improving America's Schools Act (IASA) mandated national biennial assessment of individual students and charged NAGB with determining which subjects to test, performance standards, instruments, and reporting results. A new national system of assessments, to include performance items, was to be voluntary.

1994 GOALS 2000: Educate America Act established national educational goals requiring that, by year 2000: (1) all children will have access to preschools that prepare them for school; (2) 90% of students will complete high school; (3) all students will demonstrate competence in prescribed subjects in grades 4, 8, and 12; (4) all teachers will have access to professional development; (5) U.S. students will be first in the world in achievement in math and science; (6) all adults will be literate and able to compete in a global economy; (7) all schools will be free of drugs, alcohol, and violence; and (8) every school will promote parental participation in children's development and education.

2002	No Child Left Behind Act of 2001. George W. Bush signed into law the No Child Left Behind Act on Jan. 8, 2002. This act declares that all states must implement statewide accountability systems, which will: • Set academic standards in each content area for what students should know and be able to do, • gather specific, objective data through tests aligned with those standards, • use test data to identify strengths and weaknesses in the system, • report school academic achievement to parents and communities, • empower parents to take action based on school information • direct changes in schools that need help.

How Traditional Assessments Relate to Authentic Assessments

Assessments that allow multiple right answers and authenticate a student's response have been regularly employed in reading and writing environments. Authentic assessments have the potential to allow for individual student differences and represent a more collaborative approach to assessment. Authentic assessment's collaborative approach address improvement, effort and achievement while traditional assessments focus primarily on achievement (Tierney, Carter, and Desai, 1991).

In portraying a negative perspective on traditional assessments Kohn (2000) contends that schools whose focus is to raise standardized test scores tend to abandon learner-centered environments to not only teacher-centered, but more destructively to a legislature-centered environment.

In advocating for the use of authentic assessment for reading and writing Tierney et al., (1991) make the following comparisons:

Table 2 *Comparisons between Authentic and Traditional Assessments*

Authentic Assessments	Traditional Assessments
Represent a broad range of assignments which students are engaged in;	Assess students across a limited range of assignments;
Allow for individual differences between students;	Assess all students on the same dimensions;
Represent a collaborative approach to assessment;	Assessment processes are not collaborative;
Have a goal of student self-assessment;	Student self-assessments are not goals;
Address improvement, effort and achievement;	Focus predominately on achievement;
Link assessment and teaching to learning.	Separate learning, testing and teaching.

In addressing the question of validity, researchers, Supovitz and Brennan, (1997) investigated whether alternative assessments result in greater equity than standardized tests with regard to gender, socioeconomic status, and race/ethnicity in the Rochester, New York school system. The authors related that their main dilemma was that in order to judge which assessment is actually closer to real student performance, they needed to know each child's true ability. They admitted that since they had no way of knowing the true ability of each student they cannot fully determine which assessment is more biased; that is, which assessment deviates farther from each child's true ability in ways that are associated with the child's gender, race/ethnicity, socioeconomic status and English language learner's status. Due to this limitation, the authors could only compare the two assessments relative to each other, but they could not say how close either of the assessments is to an ideal situation where systematic bias is eliminated. Although the authors could not determine which is more biased, they found that portfolios are more consistent in regards to race/ethnicity, but less consistent in regards to gender.

Neil and Medina (1989) have also researched the question of assessment validity and have come to the conclusion that performance and other authentic assessments have the potential either to be fairer or to magnify existing inequities. Test validity is then tied to the purposes for which an assessment is used.

According to Sacks (1999) standardized testing--especially in the high stakes arena--tend to narrow the curriculum by encouraging a "teach to the test" approach in the classroom. Not only is narrowing the focus of the curriculum a concern, but also the pressure to provide inappropriate modifications to raise scores.

Alternative assessments have been promoted to provide a more equitable appraisal of students' achievement levels. However, it is a mistake to assume that shifting from traditional standardized tests to authentic assessments will necessarily lead to equality of performance (Linn, Baker and Dunbar, 1991). The task then is to find assessment strategies that measure criterion reflecting the life experiences and values of the learner. The marriage of authentic assessment and authentic teaching takes on increased significance. Linn et al. mention that gaps in performance exist among groups because of differences in the familiarity and exposure of the students being assessed. The development of assessments that take into account the diversity of today's student populations can make a substantial difference with many at-risk students who come to school deficient in prior knowledge that is important to school achievement. Linn maintains that an important outcome of the attention given to alternative assessment is that the educational community is reconsidering what are valid interpretations of any kind of assessment information.

Educational Implications of Assessment's Impact on Instruction

In analyzing how assessment policies alter classroom teaching, Wong and Anagnostopoulos (1998) maintain that in the case of the Chicago low performing schools the district's use of standardized reading test scores as the measure of school performance resulted in schools and teachers targeting resources on activities specifically linked to raising test scores thus affecting what teachers taught. These actions implied a connection between assessment strategies and pedagogy.

Avery (1999) maintains that despite the increasing use of authentic assessments very little empirical research has explored the nature of authentic assessments, performance-based assessments, or their relationship to instruction and learning. Stecher (1998) supports the position that questions about the impact of portfolio assessments on school practices have not been given as much attention as other authentic assessments. Little evidence exists to show the effects of portfolio assessment on instructional practice. The initial research on portfolios has almost always focused on the quality of the information they provide, their reliability and validity and not their impact on teaching practices (Stecher, 1998).

In Nystrand's (1997) view, monologic assessment practices contribute to a setting that does not assign significant and serious epistemic roles to students that the students themselves can value. According to Dietel, Herman, and Knuth (1991) alternative assessment strategies have led the quest for more meaningful assessments to better capture the significant outcomes we want students to achieve and better match the kinds of tasks which they will need to accomplish in order to assure their future success.

Understanding assessment terms, principles, and options is important for educators. Teachers are increasingly expected to develop new assessment methods and to select assessment materials skillfully. Standards for Teacher Competence in Educational Assessment of Students jointly developed by the American Federation of Teachers, the National Council on Measurement in Education, and the National Education Association in 1990, stated that teachers should be skilled in

- choosing appropriate assessment methods;
- developing appropriate assessment methods;
- administering, scoring, and interpreting assessment results;
- using assessment results in making decisions about students, instruction, curricula, and schools;
- valid grading
- communicating assessment results to students, parents, other educators, and other audiences; and
- recognizing unethical, illegal, and inappropriate assessment methods.

Despite these increased expectations, teachers are rarely offered useful training in assessment. This resulted in confused attempts to improve classroom assessment.

Factors Influencing the Implementation of a Comprehensive Portfolio Assessment Plan

The factors that influenced the implementation of a comprehensive portfolio assessment plan include: Time and Scheduling, Roles and Responsibilities, and Technology Support.

Time and Scheduling

While many reasons are given for why portfolio assessment is not practicable the most common complaints involve the perceived lack of time. The key to successful assessment reform, however, is not finding more time (to do the same things we now do) but to deploy time, so that as we are mindful of a new goal we are working smarter—not harder (Wiggins, 1998). Central to rethinking and deployment of time is coming to the understanding that non-contact time for teachers (that is, time when teachers are not obligated to students) is essential and must be planned for. For this to be feasible on a practical level it must be accomplished through incremental changes.

Roles and Responsibilities

Developing a portfolio is a team effort. This process needs to be supported by the administration, teachers, parents and students. As Cibulka and Derlin (1998) advocate, for an assessment system to be viewed as authentic "the results it produces, or seems to produce, are credible in the eyes of a variety of audiences (e.g., policy makers, administrators, teachers, parents, and students)" (p. 80).

Students need to be invested in the portfolio process. Students need to have a sense of ownership of the process as well as the product. Portfolios should be viewed as the property of the student--not the teacher or the school. The teacher may use the selected pieces of the student portfolio to include in the teacher's own portfolio, but it is necessary to establish the understanding that students consider these portfolios to be their own. There are various ways teachers can support a feeling of student ownership.

- Ensure students have a major say as to what is included or excluded;
- Maintain easy physical (or electronic) accessibility of the portfolios for students;
- Ask students' permission to share or look over their portfolio;
- Develop in classmates a respect for one another's portfolios;
- Make joint decisions on developing portfolios, sharing and other matters relating to the portfolio process (Tierney et al., 1991).

Technology Support

Technology presents a means and an opportunity for students and professional educators to reach out to the global community. Portfolios are vehicles for one to utilize his/her creative talents to exhibit authentic assessment. The most common format for a portfolio has been a three-ring binder into which a collection of carefully selected artifacts was organized. Although this format has its advantages, the electronic portfolio is rapidly gaining popularity.

By combining the portfolio process with technology, the uses are many and varied. An electronic portfolio can be viewed by a single user on a personal computer as well as displayed to a large group using computer presentation equipment. They take up a significant amount of computer memory, especially pictures, sound, and video clips. To copy an electronic portfolio for backup purposes or distribution to prospective reviewers, a high volume storage device and/or a writeable CD must be employed. In addition to sending the storage device containing the portfolio to prospective reviewers, electronic portfolios can be posted to personal or school web sites that are accessed through the Internet.

As with most technological applications, learning how to develop an electronic portfolio requires initial time and energy. However, once the portfolio is properly developed, revisions can quickly and easily be made. The electronic portfolio then becomes a dynamic vehicle that students and professional educators will continuously improve as their qualities continue to grow and change.

Effective Portfolio Management

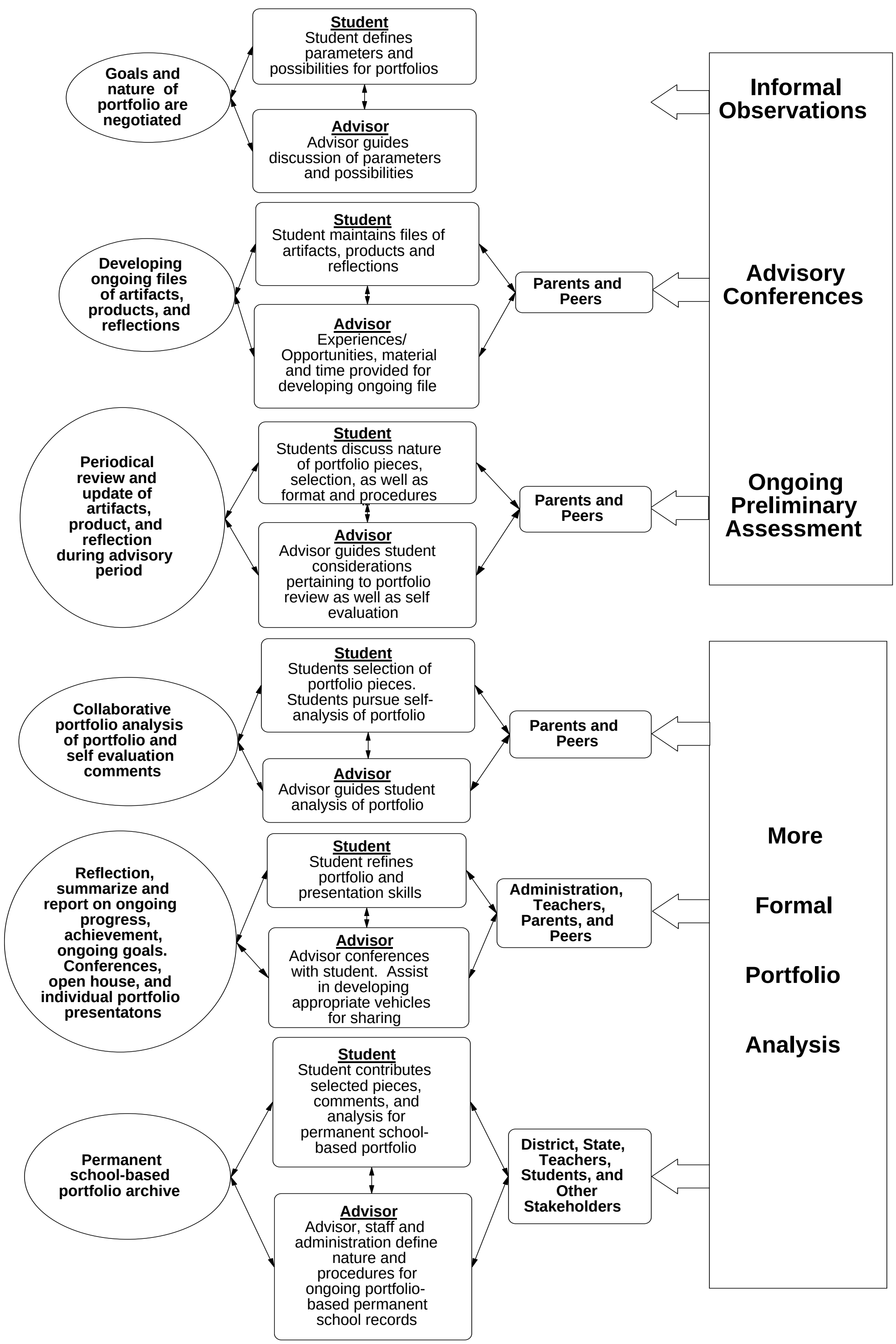
The design of an effective portfolio system should be attentive to four critical areas:

1. Documenting, assessing, and reporting individual achievement so as to support valid inferences of their achievement.
2. Documenting and reporting the quality of the school's educational program.
3. Providing an assessment program that supports and protects the school's ideology and practices.
4. Providing a coherent structure with built-in flexibility to accommodate diversity among students and teachers.

Guide for Ongoing Portfolio Development

Figure 1 was developed as a suggestive guide for ongoing collaborative portfolio development, refinement,reflection, analysis, and presentation.

Figure 1
Guide for Ongoing Portfolio Development



Conclusion

One implication of the research findings is that all of us who develop, use, or evaluate educational assessments need to expand our repertoire of epistemological strategies and consider alternative models for warranting validity conclusions--models that might support teachers' interpretations of their students' learning based on individual portfolios and recorded observations (Moss, 1992). In addition to considering the social consequences of assessment-based interpretations and actions, we need to consider the social consequences of the methods by which we warrant those interpretations and actions.

Successfully implementing portfolios as comprehensive assessments is complex and involves a myriad of issues. Despite the potential that portfolio assessments offer, the intellectual and resource demands of developing a portfolio assessment strategy are immense. Managing and planning the portfolio process is an ongoing activity. One must also realize that "by embracing alternative assessments, educators are beginning rather than ending a complex process" (Baker, 1994, p.58). As Kohn (2000) advocates, the question of appropriate assessments represents a series of decisions that should be questioned and revisited.

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