

BLESS – A Layered Blended Learning Systems Structure

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Abstract: Learning processes using New Media tend to be extremely complex. It is not too surprising then that current research appears rather scattered and dominated by the more tangible issues such as content and learning platform design in a bottom-up approach. While initially this appears practical, we are convinced that advanced learning platforms need to be designed to optimally support the underlying educational process based on learning theories (top-down approach). This paper proposes the Blended Learning Systems Structure (BLESS) model that introduces a layered architecture for decomposing the complexity inherent in the transition from courses to their effective support by learning technologies. In particular, BLESS is intended to act as a reusable framework for decomposing complex blended learning processes into smaller, more tangible and reusable learning activity patterns that may subsequently be used to guide blended course design and effective use of learning technology.

Key Words: Blended Learning Systems Structure (BLESS), blended learning, Person-Centered e-Learning (PCeL), patterns, learning technology, learning design

Category: K.3.1 Computers and Education (Computer Uses in Education)

1 Introduction

Blending classroom teaching and learning approaches with the use of Web technologies is currently one of the major topics in e-learning research, both in educational and workplace environments. Among several research threads, a recent and highly relevant one concentrates on capturing successful blended learning practices [Derntl and Motschnig-Pitrik 2004a] and design experiences inherent in existing learning management systems [Avgeriou et al. 2003] in the form of reusable patterns [see Alexander et al. 1977], [Goodyear et al. 2004]. Since we have found that one of the most critical factors of successfully blending online with face-to-face learning is making *situated* and *targeted*, thus *deliberate* use of learning technology, we aim to capture successful blended scenarios for dissemination and reuse across educational domains. For example, using means of computer-mediated communication (CMC) such as online discussion forums for preparation of meetings or workshops is certainly situated and targeted [Dietz-Uhler and Bishop-Clark 2001]. However, acquiring comprehensive knowledge, experience, and a sense of which activities are suitable for what kind of online interaction, or which activities are

preferably conducted face-to-face, is impossible to achieve within one or two application cycles.

Therefore, in our view the researcher/practitioner needs to build awareness towards two basic dimensions of blended learning:

Structural dimension. First, the *structural* (vertical) dimension addresses the space between didactical considerations and the employment of Web technology for teaching and learning purposes. What lies *between* these two? How can we project and support learning activities on a learning platform in a *situated* way? How can technology be employed to *enrich* learning processes? The current state of blended learning research resembles rather a phase of experimentation: reports are mostly experience-based, deductive in reasoning and often lacking cues on how to generalize employed scenarios and conclusions to enable transfer to other domains [see Nichols 2003]. The fundamental question, “what is the added value for learning and how can that added value be achieved?”, tends to be buried in a myriad of undoubtedly important but quite unstructured issues, ranging from finding identities in purely virtual networks over user interface issues to acceptable response times when downloading e-content from remote sites. While all these issues are essential in specific contexts, they need to be addressed more systematically and, whenever possible, features should be investigated and discussed in relationship to existing or new theories.

Dynamical dimension. Second, the *dynamical* (horizontal) dimension addresses the change that technology brings about for learning processes over time. Introducing blended learning is certainly not a one-time effort. Rather, it follows an iterative, incremental process where technology should act as the *enabler*, with both established [Rogers 1983], [Schank 1997], and new, media-didactic learning theories [Kerres and de Witt 2002], [Mayer and Treichel 2003] acting as the primary *drivers* of change. This line of argumentation is currently gaining increasing support, e.g., [Hamid 2002] records that “*unfortunately ... the emphasis on e-learning in the past has been on the ... technology. There is a need to shift the emphasis ... to the learning*”.

The Blended Learning Systems Structure (BLESS) model of blended learning as presented in [Section 2] addresses precisely these issues, as it aims to provide a structural and dynamic framework for both blended learning practice and research.

2 The BLESS Model

2.1 Motivation

As computer scientists and educators with deep interest in significant and effective learning we soon realized that neither learning platforms nor learning paradigms in isolation can provide the support that educators require to implement effective blended learning scenarios. Rather, a socio-technical solution that co-considers educational concerns and technical support is needed in order to promote technology-enhanced educational practices that are as intuitive and close to its users as possible. But how can we bridge the wide gap between educational practices and learning

platform elements that are tailored to support these practices? And how can we achieve that such practices and supporting learning platform elements (better: *molecules*) can be propagated and reused in different courses, settings, and even across institutions?

Computer science has a long tradition in building models of real-world phenomena in order to support them by computerized means. On several occasions – recall, for example the famous ISO/OSI Reference Model [ISO 1994] – computer scientists have come up with layered approaches to decompose complexity inherent in real-world systems. Equally, a layered model that is depicted in [Figure 1] provides the core structure in our approach and allows us to consider individual issues highly systematically, time at a time in the transition process from teaching/learning situations to their technological support. In order to better understand the contribution of the BLESS model, let us track the process of experience that led to its discovery.

2.2 Origin and Structure

In order to capture and also to better understand and support our teaching/learning practices, we started to visually model our own teaching/learning scenarios, to collect students' feedback and to figure how the scenarios could best be supported by Web technology. Soon we came to realize that a number of scenarios proved effective in different courses. This led us to generalize them and to model and describe them as patterns, including structure, flow of activities, and several other parameters [Derntl and Motschnig-Pitrik 2004a]. These patterns could be instantiated in different contexts. Good design practice told us to keep patterns independent of any specific implementation as long as possible. Yet, finally the patterns needed to be implemented. This requirement introduced another layer into our model: the Web template layer. Essentially, *Web templates* are sequences of interactive screens (similar to wizards) specifying the implementation of precisely those interactions like uploading files, issuing comments, responding to questionnaires, etc., that are part of the Web-based molecules of the educational processes. Thus, while scenarios and patterns model Web- as well as face-to-face practices, Web templates provide implementation specifications for those Web-supported features that closely match their users' needs within the educational process in action. Note that, while some Web templates (e.g., forum discussion on some topic) can more or less easily be realized by elements provided by commercial platforms, others, like performing a peer-evaluation, cannot. For showing reference implementations of these Web templates, in particular, we have already and are still in the process of implementing a set of open-source XML Web Services that are described in more detail in an accompanying paper in this volume [Mangler and Derntl 2004].

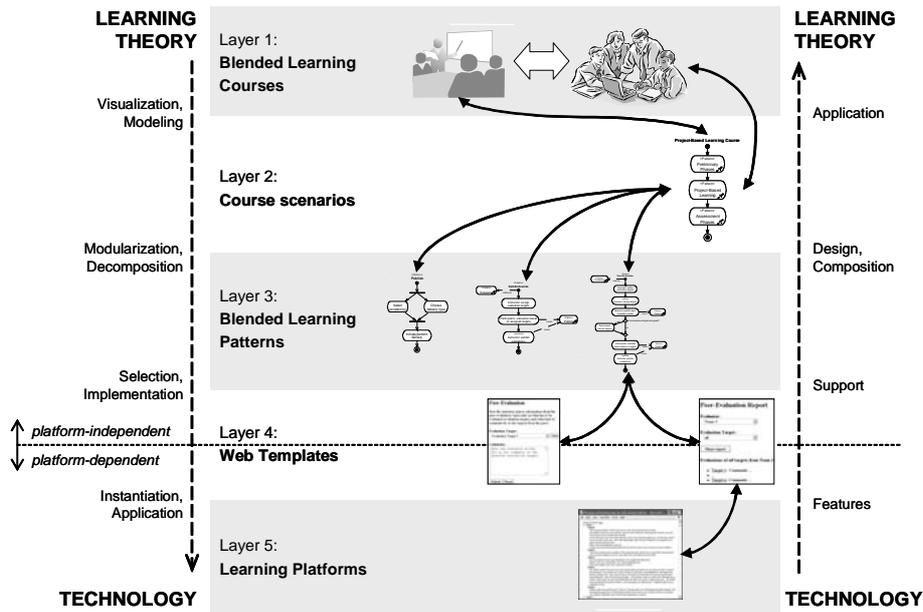


Figure 1: The Blended Learning Systems Structure (BLESS) model

2.3 Instantiating the BLESS Model for Person-Centered e-Learning

In the Person-Centered e-Learning (PCeL) patterns project [see Derntl 2004], [Derntl and Motschnig-Pitrik 2004a], [Derntl and Motschnig-Pitrik 2004b], the BLESS model as depicted in [Figure 1] is used as a framework for mining, applying, evaluating, and improving blended person-centered learning scenarios. Its layered structure evolved from the necessity to decompose the complexity inherent in the transition from actual course practice and design to the implementation of Web-based services for learning support. Note that the layers are designed to stay platform-independent as far as possible. Further note that each layer intertwines didactic and technical issues such that both aspects are co-developed. The layers and transitions of the BLESS model as applied Person-Centered e-Learning are described in the following:

Layer 1: Blended Learning Courses

The top layer represents *concrete* blended learning courses employing learning technology. In our context, these are driven by humanistic educational principles, in particular Carl Rogers' Person-Centered Approach [see Rogers 1961]. These driving inputs can be imagined on yet another level, say level 0, feeding into level 1 that integrates technology-enhanced elements into the basic philosophy of Person-Centered education.

Layer 2: Course Scenarios

This layer aims at semi-formal, conceptual modeling and visualization of concrete scenarios by modeling their sequence as activity diagrams in the standard Unified

Modeling Language (UML) [OMG 2003] notation. This is the first step of pattern mining: course activities are combined and generalized into self-contained learning activity patterns. For example, in a PBL course the participants engage in an iterative problem-solving process, whereby in terms of patterns, *Project-Based Learning* can be arranged as a sequence of *Project Milestones*. Such a modularization and abstraction process (link to layer 3) entails substantial advantages for the analyst and course designer, as it enables reuse of these patterns for both course scenario description (link from layer 1) and application (link to layer 1).

Layer 3: Blended Learning Patterns

Architect Christopher Alexander [see Alexander et al. 1977] employed patterns to deal with the construction of towns and buildings using architectural design and arrangement techniques based on a set of values that characterize well-being. Similarly, the pattern approach to blended learning employs patterns for capturing and guiding course- and learning activity design based on humanistic educational values such as transparency, self-direction, and learning from peers. Examples of patterns include online knowledge gathering and construction in teams or groups, publishing of electronic content, interactive elements like online or face-to-face brainstorming, discussion, several forms of feedback, evaluation and assessment, as well as other blended learning techniques. The patterns are described uniformly to support quick location as well as comparability of relevant patterns in the *Pattern Repository* [see Derntl 2004]. The modularization transition from layer 2 to layer 3 enables more tightly focused and selective implementation (link to layer 4) as well as evaluation of patterns. On the other side, by compiling and combining single patterns a new course or learning activity scenario model can be formed (link to layer 2) and subsequently applied and evaluated in concrete courses (layer 1).

Layer 4: Web Templates

The Web templates at layer 4 are derived from the patterns and show parameterized, interactive Web pages that describe how learning platform utilities (*atoms*) can be arranged and combined such as to build *molecules* in a way that optimally maps the underlying process pattern onto the learning platform (link to layer 5). Generally, Web templates are restricted to utilization of basic hypermedia Web technologies such as hypertext, multimedia, and Web forms. Each Web template shows three complementary views:

- *Participant view*: This view shows a number of generic, interactive Web page specifications that are hyperlinked among each other. In combination, the Web pages described in that view should be capable of allowing for accessing and using all the functionality that is needed to support a pattern from the viewpoint of the course participant.
- *Administration view*: Each pattern, when supported on a learning platform, is depending on a set of parameters that influence its appearance and behavior in the participant view. In order to instantiate a pattern on a learning platform, an administrator has to supply values for the pattern's input parameters and options (i.e., the *configuration*). For example, an online discussion forum may allow

course participants to post replies to existing threads or messages, but may deny them to create their own discussion threads. Such a configuration has to be specified by an administrator in the administration view. Note that configurations made in the pattern instantiation process may be stored for subsequent reuse and modification.

- *Report view*: One frequently recurring task of any online course instructor/facilitator is collecting information about (online) learner activities. Using standard learning platforms, this can turn out to be very annoying, as you have to browse through various pages and either print each desired page or copy and paste desired sections into a separate report document. The Web template report view aims at alleviating the reporting process by providing tailored, situated report views on each pattern. Thereby, the report application must be capable of extracting relevant information from the data that was collected by the online pattern instances during the learning activities.

Layer 5: Learning Platform

To support a pattern's learning scenario on a learning platform, the respective Web templates as well as those of dependent and included patterns have to be implemented or supported on that learning platform. This can either be achieved by arranging existing features offered by that platform, or by realizing a custom implementation of the respective Web templates (in the sense of a platform extension) if the platform does not offer sufficient feature support through its default configuration options. Only when the learning platform offers the functionality specified in the Web templates, the respective patterns can be instantiated on that learning platform.

For example, in the *Online Discussion* pattern instantiation process the instructor only has to specify the location of the discussion forum by selecting a learning activity or Web page to which the forum shall be anchored, as well as some optional parameters regarding its usage: e.g., whether course participants should be allowed to initiate their own discussion threads. If such options are supported by the learning platform, *Online Discussion* instantiation will be an easy process. However, often enough only compromise solutions are feasible because of constraints imposed by commercial learning platforms. In such cases, the Web templates may be used as generic specifications for implementing custom platform extension modules that allow for the optimal set of configuration and usage options.

For prototyping purposes some Web templates were implemented on top of the *CEWebS architecture*, which provides a Web-service-based architecture for cooperative learning environments (see [Mangler and Derntl 2004] in this volume for more detailed information on CEWebS). Previous evaluation [see Motschnig et al. 2003] has shown that, when accompanied face-to-face by a supportive instructor/facilitator, this kind of simple user-centered Web support for learning activities is something that students appreciate more than a complex learning platform.

3 Conclusion

The BLESS model provides an integrated structural and dynamical framework for dealing with the complexity inherent in blended learning scenarios. In this respect, we see conceptual modeling and layered architectures as powerful tools to describe and enable pattern-based reuse of successful blended learning scenarios both top-down and bottom-up. We have stressed that technology should not be the driver but rather an enabler of deeper and more meaningful learning processes. Furthermore, we have illustrated how a stepwise transition can be made from fuzzy and complex real-world processes to learning platform features that directly support users' online activities. The BLESS model is intended to contribute to more disciplined and comparable research and practice of blended learning and hence to effective progress in deeper and more significant learning in and across institutions.

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