# Active Learning in IS Education: Choosing Effective Strategies for Teaching Large Classes in Higher Education

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**Abstract**

*This study investigates teaching with active learning techniques, as a means of enhancing student motivation and learning in large IS classes. The combination of traditional lectures with active learning techniques to promote participation in large classes is explored. Implications for IS teaching, student learning, and future research are also presented.*

**Keywords**

IS Education, Active Learning, Cooperative Learning, Large Classes.

## INTRODUCTION

With rising enrolments and decreased funding large classes have become a norm for higher education. Although large classes facilitate a common background for participants and are economically desirable, they present a number of challenges to the educator. One of the greater challenges in dealing with large classes lies in how to effectively engage students in a learning process that improves student learning and achieves higher education goals.

## BACKGROUND

### The Lecture Approach

Traditional pedagogy of higher education utilises the lecture as the most common means of face-to-face instruction, especially in the large class setting. The lecture approach has a number of advantages. Lectures present a minimum threat to students and can be used to communicate intrinsic interest on topics, convey large amounts of factual information, address large groups (which is often economically viable), support teacher control, and foster learning by listening which is particularly advantageous for those who learn best in this manner (Nelson 1999). However it is the latter aspects of teacher-centredness and passive learning that are most criticised (Felder 1999, Jenkins 1994). Indeed, Jenkins (1994) suggests that higher education goals involving understanding and the application and evaluation of ideas, are not readily achieved in a passive learning environment. Other criticisms include lack of feedback to the lecturer and student about student learning, inability to sustain student attention, poor recall of lecture material, and the assumption that all students learn at the same rate, with the same level of understanding, and use similar learning strategies (Jenkins 1994, Nelson 1999).

Educators are therefore challenged to repackage traditional subjects and theoretical concepts in new and engaging ways (Tucker 1996). Since students have a range of learning styles and backgrounds, there is also a need to develop teaching strategies that appeal to the range of students that participate in large classes. For example, by varying student activities during a lecture session one can help renew attention, generate interest, provide opportunities for students to think, and provide useful feedback on student understanding.

There are a number of movements in education that challenge the traditional pedagogy of teaching in higher education. These include increased dependency on computer-enabled teaching aids, the use of learning styles to inform on ways of designing learning activities, and the use of active learning strategies. This paper reports on a preliminary investigation of the use and usefulness of active learning in the context of information systems (IS) teaching in large classes.

## The Case for Active Learning in IS Education

In the active learning environment students interact with each other for the purposes of learning. Here, the instructor can either abandon or reduce the amount of direct instruction, adopting the role of facilitator (Jones 1988). Jenkins (1994) also suggests that lecture time might be better spent focusing on the higher level goals of analysis and synthesis; to promote active learning in the lecture situation, teaching must therefore transcend traditional attempts to convey a lot of information in the time allocated.

Gamson (1996) reflecting on her experiences with active learning approaches comments:

> *"the evidence is very strong that these social forms of learning are very effective in increasing retention…, encouraging much more complex thinking about complex issues than we have come to expect from our students, and encouraging acceptance of different ways of learning on the part of the students and faculty. The motivation for learning goes up [when these approaches are used] … these kinds of approaches don't happen automatically; in fact, they need to be very carefully designed."* (NTFL, May 1996, 5:4)

The IS'97 Curriculum report (Data Base 1997) advocates four levels of knowledge (ie. awareness, literacy, usage/comprehension and application) as applicable to IS undergraduate studies and supports active learning as a teaching mechanism for promoting the higher knowledge levels of usage/comprehension and application (See Table 1). Indeed, the IS'97 Curriculum report suggests that cooperative learning, a fundamental technique advocated by proponents of active learning (eg. Johnson & Johnson 1994, Slavin 1990), offers advantages of increased student motivation, provides good support for the development of application level competencies, encourages the development of interpersonal communication skills, and better simulates the workplace setting in which graduates will perform.

Achieving success with active learning in the lecture situation is neither easily done nor its effectiveness readily assessed. Indeed, among the issues surrounding active learning are the questions "How does a teacher stimulate or facilitate active learning in lecture or discussion situation ?" and "Does active learning really make a difference ?" (CET 1999). To stimulate active learning a number of activities are suggested. These include simulations and gaming, role plays, experiential exercises, hands-on (lab) experimentation, case study discussions, "live" project case studies, guest speakers (who provide a real world perspective on the theory and concepts presented in lectures), questioning strategies, classroom discussions, group problem solving (eg. learning pairs), and formal and informal cooperative learning teams.

**Table 1: Knowledge Levels and Associated Learning Activities**
(Source: IS '97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems)

| Depth / Level of IS Knowledge | | Meaning of Knowledge Level | Associated Learning Activities |
|---|---|---|---|
| **1** | Awareness | Introductory recall and recognition | Class presentations, discussion groups, watching videos, structured laboratories. Involves only recognition but with little ability to differentiate. Does not involve use. |
| **2** | Literacy | Knowledge of framework and contents, Differential Knowledge | Continued lecture and participative discussion, reading, teamwork and projects, structured labs. Requires recognition knowledge as a prerequisite. Requires practice. Does not involve use. |
| **3** | Concept/Use | Comprehension and ability to use knowledge *when asked* | Requires continued lab and project participation, presentation involving giving explanations and demonstrations, accepting criticism; may require developing skills in directed labs |
| **4** | Detailed Understanding and Application | Selection of the right thing and using it *without hints*. | Semi-structured team-oriented labs where students generate their own solutions, make their own decisions, commit to it and complete assignments, and present and explain solutions. |

This study seeks to address the two aforementioned issues (CET 1999) in the context of IS education:

> *"How does a teacher stimulate or facilitate active learning in lecture or discussion situation ?"* and
>
> *"Does active learning really make a difference ?"*

The remainder of this paper describes an active learning event (based on informal cooperative learning), and other strategies used in the context of teaching a large IS class. These events and teaching mediums seek to vary the mode of instruction and student activities within the lecture session, towards encouraging student participation, interest, motivation and learning. In particular, it is expected that the active learning event will provide opportunities to think, encourage student participation in class discussion, and provide useful feedback on student understanding.

## THE STUDY

The undergraduate IS course, entitled *Information Systems Development*, is a Level 2 course. This paper is taken mainly by those pursuing a three-year program of study towards a Bachelor of Commerce. The student population consists of Computer Science (CS) majors, IS-majors and those wanting to be IS-literate but not necessarily IS-professionals. Students enter the course having taken Level 1 foundation courses in either CS or IS. The course has a current enrolment of 160 students. The course is divided into two semester-length segments: one segment focuses on IS analysis and design, the other on object-oriented systems development. This study focuses on strategies used to teach in the IS analysis and design segment.

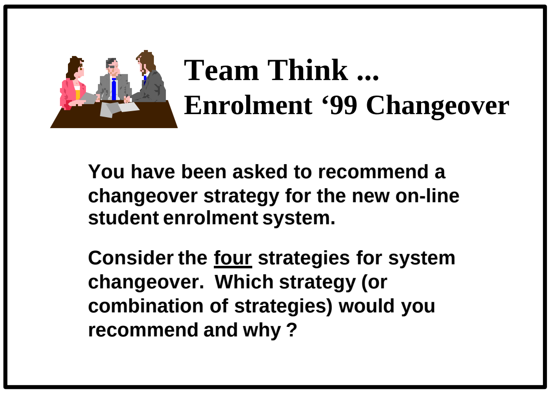
The primary mechanism for "whole group" instruction is the lecture (duration: 1 hour 50 minutes). Lecture attendance is not compulsory. Text readings and the use of Microsoft PowerPoint visuals/handouts support material delivery. The PowerPoint slides are normally available to students for printing prior to the lecture session. The lectures are normally very structured. Although students are urged to prepare for class sessions using the recommended text readings, this seemingly, is not always the case.

Students enrol in tutorial groups of 20-25 students (Duration: 50 minutes). Seventy-five percent of the tutorials were discussion-based; for the remaining sessions, hands-on lab exercises and simulation/games were used where a suitable resource was available. For example, Microsoft Project software was used to support a lab-based tutorial on Project Management, while the MIS Game[1] (Martin 1996) was used to help students appreciate the issues, concepts, jargon, and trade-offs in the management of IS development projects. Although students are encouraged to attend the weekly tutorials, attendance is not compulsory. The class tutors use discussion guidelines to ensure consistency and coverage of main points, but these guidelines and tutorial solutions are not normally distributed to students. Finally, students are required to self-select themselves into teams that undertake a study of a "live" IS development project of their choice; a report (worth 20% of the course grade) is submitted at the end of the project.

While the project method lends itself to team-based learning and cooperation and tutorials are more easily organised to include interactive events, fostering participative learning in plenary lecture sessions proved more challenging. To encourage active participation in lecture sessions, the lecture/discussion approach was used. Here the instructor lectures to provide some essential information and then puts forward a number of questions for the students to answer. These questions focus on analysis and application, rather than restating the material presented. This approach provides opportunities for more active student involvement than does the traditional lecture. However, where individual contributions were expected in the classroom discussion, there was obvious reluctance to participate. To overcome individual inhibitions to participate, informal cooperative learning techniques, a variant of cooperative learning, for class discussion was used (Johnson & Johnson 1994, Seeler et al. 1994, Slavin 1990). Here students worked together in ad-hoc four-member teams to apply concepts and master material initially presented in lecture session; one such application is described below.

## The "Team Think" Approach

**Figure 1:**
**An example of a Team Think Activity**




A "Team Think" event is identified as a problem scenario to which students are required to formulate a response (See Figure 1). A scenario is presented on an overhead transparency or PowerPoint slide. Students then form themselves into ad-hoc four-member teams, identifying those sitting nearby as members of their team. They are encouraged to introduce themselves and to select a team spokesperson who will convey what the *team thinks* during the plenary discussion. The team is then given about 3-5 minutes to work through the problem scenario and formulate a response. During the discussion, the lecturer

[1] The *MIS Game* is an innovative game for teaching Information Systems Development within a simulation/gaming context.

assumes the role of facilitator.

The first team to present their response to the problem scenario is selected by the facilitator. In this class, tossing a "funny-faced" soft yellow ball among the teams supported the selection process - the team receiving the ball provides their response to the problem scenario. The team spokesperson presents what the *team thinks* - good solutions are actively encouraged and poor solutions tactfully addressed in a way that helps the team (and the class) to understand and correct the response. That team then selects the next team to respond (by tossing the ball) and so on. Other teams can join the discussion at any time - comments on a previous response or proposing a solution that differs from previous responses are especially encouraged. At the end of the discussion, the facilitator summarises the main points, may offer additional solutions, and endeavours to leave the class with a sense of knowing the *solution(s)*. Two such sessions are normally incorporated in the lecture, but the number may vary according to time available.

## METHODOLOGY

A self-administered survey questionnaire was used to capture both quantitative and qualitative data regarding the effectiveness of various strategies used to support classroom teaching and learning. The surveys were distributed in the final session of the 12-week IS analysis and design segment, in mid-June 1999. Of an attending class size of approximately 120 students, 106 surveys (88.3%) were returned. Of the respondents, 65.7% were male and 34.3%, female. 24.5% of the respondents were under 20 years of age, 48.1% were aged between 20-24, and the remaining 16.3% were aged 25 and over. Seventy-nine percent of the participants were $2^{nd}$ or $3^{rd}$ year students. 18.9% of the students identified themselves as CS Majors, while 73.6% identified themselves as business majors (with some IS). While 21% of the respondents had taken only CS papers as their pre-requisite papers, 78.1% had some IS background. See Table 2.

**Table 2: Participants Profile**

| | | | |
|---|---|---|---|
| *Gender:* | % | *Major* | % |
| Male | 65.7 | Business-related | 73.6 |
| Female | 34.3 | Computer Science | 18.9 |
| *Age Group* | | Other | 7.5 |
| Under 20 years | 24.5 | *Academic Background* | 21.0 |
| 20-24 years | 48.1 | CS courses only | |
| 25-29 years | 14.2 | IS course(s) only | 61.9 |
| 30 years and over | 12.3 | IS & CS courses | 16.2 |
| *Origin* | | Other | 1.0 |
| European | 71.2 | *Grade Expectation* | |
| NZ Maori | 0.2 | A | 17.1 |
| Asian | 19.2 | B | 66.7 |
| Other | 8.7 | C | 15.2 |
| | | D | 1.0 |

## MEASURING THE STUDY VARIABLES

The following measures were used to assess the variables of interest:

- Perception of teaching effectiveness. Two items were used to assess student perceptions of the effectiveness of the teaching strategies used in this course:
    - Effectiveness of individual strategies. Alongside the traditional lecture, interactive class events (ie. Team Think), visual aids, and an industry guest lecture were used to vary the mechanisms of material delivery and support student learning. Using a 5-point scale ranging from "*Very Ineffective*" to "*Very Effective*", the respondents were asked to indicate the extent to which each strategy was perceived as effective in respect of their learning. If the respondent did not participate in an event (eg. industry guest lecture), a "*Did not attend*" option was checked.
    - Overall Effectiveness. For this item, respondents indicated, on a 5-point scale ranging from "*Very Ineffective*" to "*Very Effective*", the extent to which the teaching strategies used were effective or ineffective.
- Ranking of Teaching Strategies. Respondents were asked to identify and rank, at most, three strategies which, they found most effective for their learning. A brief comment on why this was perceived to be so was also given.
- Motivation to learn. Respondents indicated, on a 5-point scale ranging from "*No, not at all*" to "*Yes, definitely*", the extent to which they felt motivated to learn in this course.
- Expected Grade. For this item, respondents indicated their expected grade for the course, ranging from an A-grade to an E-grade.

## THE RESULTS

### Quantitative Analyses

The quantitative data were assessed using descriptive analyses and analysis of variance; SPSS for Windows Release 8.0.0 was used.

**Table 3: Effectiveness of Teaching Strategies used in Lecture Sessions**

| | Effectiveness of Teaching Strategies | | | | |
|---|---|---|---|---|---|
| | Very Ineffective | Moderate | Very Effective | Mean | *SD* |
| 1. Traditional lecture | 2.8% | 26.4% | 70.8% | 3.83 | 0.75 |
| 2. Use of visual aids | 0.9% | 14.2% | 84.9% | 4.10 | 0.66 |
| 3. Interactive class event | 7.6% | 37.1% | 55.2% | 3.58 | 0.78 |
| 4. Industry guest lecture | 4.7% | 27.9% | 67.4% | 3.97 | 0.90 |
| Overall effectiveness | 1.9% | 13.5% | 84.6% | 3.96 | 0.59 |

In their assessment of the teaching strategies used in this course, 84.6% of the participants indicated that the methods used (in general) were very effective (Table 3). Of the teaching strategies assessed, 84.9% of the respondents rated the use of visual aids as a very effective method for student learning; this was followed by the traditional lecture (70.8%), the industry guest lecture (67.4%) and interactive class events (55.2%). In general, students agreed that visual aids, the traditional lecture, the guest lecture and interactive class events were all useful techniques for student learning.

Ninety-nine percent of the respondents expect to pass the course, with 83.8% expecting a B-grade or higher. In respect of motivation to learn, 56.7% of the respondents indicated high motivation to learn in this class while 34.6% indicated moderate motivation, and 8.7% indicated "lack of motivation" (Mean = 3.60; *SD* = 0.84).

Respondents were also asked to select and rank the three strategies considered most useful for their learning and to comment on why this was so[2] (See Table 4). Of the strategies, the traditional lecture was the most preferred, being ranked among the top three strategies by 57.5% of the respondents; this was followed by visual aids (54.7%), interactive class events (26.4%), and the industry guest lecture (10.4%).

**Table 4: Preferred Teaching Strategies**

| | Ranking (# of Respondents) | | | Total | |
|---|---|---|---|---|---|
| **Teaching Strategy** | #1 | #2 | #3 | # | % |
| Traditional lecture | 26 | 20 | 15 | 61 | 57.5% |
| Use of Visual Aids | 20 | 27 | 11 | 58 | 54.7% |
| Interactive class events | 12 | 5 | 11 | 28 | 26.4% |
| Industry guest lecture | 1 | 5 | 5 | 11 | 10.4% |

To test for differences in responses in respect of grade expectation and motivation, a median test and Kruskal-Wallis test was carried out.

**Table 5: Median Test**

| Grouped by: | | Traditional lecture | Use of Visual Aids | Interactive class events | Industry guest lecture |
|---|---|---|---|---|---|
| Motivation | Median | 4 | 4 | 4 | 4 |
| | Chi-Square | 16.031 | 1.529 | 21.036 | 4.050 |
| | Sig | 0.003** | 0.821 | 0.000*** | 0.256 |
| Expected Grade | Median | 4 | 4 | 4 | 4 |
| | Chi-Square | 0.988 | 2.284 | 6.864 | 4.248 |
| | Sig | 0.804 | 0.516 | 0.076 | 0.236 |

Note: *** = $p \leq .001$ ** = $p \leq .01$ * = $p \leq .05$

In respect of an association between teaching strategies and student motivation and expected grade, the results of the median test (Table 5) provide strong support for rejecting the null hypothesis regarding interactive class exercises (ie., there is no association between interactive class events and motivation to learn) at $p \leq 0.00$. The results also suggest that the null hypothesis be rejected for an association between interactive class events and expected grade, at $p \leq 0.10$. The results of the

[2] Although ten strategies (including tutorials, labs, and the project) were listed, only the four (used in the lecture session) are addressed in this paper.

Kruskal-Wallis test (Table 6) provide further support for rejecting the null hypothesis regarding interactive class exercises and motivation and expected grade at $p \leq 0.01$ and $p \leq 0.05$, respectively.

**Table 6: Kruskal Wallis Test**

| Grouped by: | | Traditional lecture | Use of Visual Aids | Interactive class exercises | The industry guest lecture |
|---|---|---|---|---|---|
| Motivation | Chi-Square | 5.585 | 2.649 | 14.609 | 4.423 |
| | Sig | 0.232 | 0.618 | 0.006** | 0.219 |
| Expected Grade | Chi-Square | 4.906 | 8.006 | 8.159 | 5.703 |
| | Sig | 0.179 | 0.046* | 0.043* | 0.127 |

Note: *** = $p \leq .001$ ** = $p \leq .01$ * = $p \leq .05$

Finally, a One-Way Repeated Measures ANOVA was used to test for differences within subjects. The results (Table 7) provide strong evidence for rejecting the null hypothesis that there are no significant differences in responses ($F$=9.375; $p$=0.003). Hence, it may be suggested that respondents are distinguishing between perceived effectiveness of the teaching strategies. However,, while the results of statistical testing suggest the respondents are differentiating between the four strategies used in lecture sessions, the strength and direction of these associations cannot be assessed due to the small sample size[3].

**Table 7: One–Way Repeated Measures ANOVA**

| | $F$ | Sig |
|---|---|---|
| Teaching Strategies | 9.375 | 0.003 |

### Qualitative Analyses

The statistical analysis of the survey data suggested that students were distinguishing between the strategies for teaching effectiveness; however, the strength and direction of this distinction could not be assessed. Nonetheless, an assessment of the qualitative data provide further support for varying activities in the lecture session, in particular, the inclusion of active learning events. Extracts from among the 109 comments received are given in Table 8.

- The Traditional Lecture. Respondent feedback suggested the lecture was most effective for coverage, explanation, generating interest, and providing direction for learning. These results are consistent with the three-fold purpose of the lecture, that is, coverage, understanding, and motivation (Brown & Atkins, 1988). For one respondent, there seemed to be a clear learning preference for the lecture approach since: "*I learn most by listening*".
- Use of Visual Aids. The results also suggested that use of visual aids and availability of these (for printing) before the lecture session were deemed effective since they provided a useful outline for adding "*comments to as the lecturer explains*" and allowed students to then focus on what was being presented or discussed.
- Interactive class events. Respondent feedback suggested that interactive class events encouraged students to "*apply what we are learning*" and to think, helped clarify ideas and obtain feedback, and "*express and discuss different ideas*". One respondent also commented

[3] To assess the strength and direction of association a 5X5 Manova (repeated measures) test would be required. This test could not be carried out since the current sample did not yield sufficient subjects for the required test matrix.

that such exercises "*relieves the boredom of lectures*", while another indicated that the interactive class events were "*better to learn and retain information ie. required thinking*".

From observation, there seemed to be a greater willingness among students to participate in classroom discussion; the fun element of selection also seemed to contribute to a more relaxed classroom atmosphere in which teams were more willing to share ideas and take risks.

While "Team Think" events initially encouraged participation by selection, it was also observed that on subsequent rounds of discussion, teams were willing to join the discussion without being preselected. Although there was still some inhibition towards participation (with team members "pass the ball" to each other or to another team), participation in and the quality of classroom discussion was improved.

- Industry Guest Lecture. Industry guest lectures help provide a real world perspective on classroom learning. As one respondent commented: "*great to see a real world application – one of my concerns over [this] degree is the lack of applications*."

**Table 6: Teaching Effectiveness – Respondent Comment**

| Traditional Lecture | Visual Aids | Interactive Class Events | Industry Guest Lecture |
|---|---|---|---|
| Covered a lot of ground and explained important points in detail<br>Concepts were explained in simplistic terms- good examples and group thinks<br>Explained the important points, less need to spend hours reading the text<br>Explanation given, and link real life situation<br>Some aspects explained further than outlined in text<br>Makes it more clear - with people explaining rather than reading it myself<br>Informative and interesting as well as stimulating<br>Know where you are going, clear, concise<br>Structured lessons. Examples done in class that are simple and relevant<br>I learn most by listening to s.o. (personal preference) | Able to listen to lecturer<br>Freed me up during lectures<br>Useful in being able to actually listen to what the lecturer said instead of writing it all down and missing what is said<br>Able to refer to and build on them during the lectures<br>Handy to have an outline to add comments to as lecture explains<br>Indicated the most important aspects of the lecture/ course<br>Brought the key points together | Able to apply what we are learning<br>Application of concepts<br>Better to learn and retain information ie. Required thinking<br>Encourages thought and good for getting different viewpoint<br>Gets people thinking<br>Made you think about what had just been discussed<br>Made understanding the ideas a lot easier by seeing it practically applied<br>Made you apply what was learnt & see different viewpoints on the same problem<br>Real life examples- relevant<br>Relieves the boredom of lectures | Good to know that what we are doing is useable<br>Good to see how the real world operates<br>Great to see a real world application - one of my concerns over a [this] degree is the lack of applications …<br>Have a touch of real life<br>Inspirational<br>It was practical, a live figure to put to the job |

In summary, the results of trialing a variety of teaching techniques seem to suggest that varying the activities within the lecture session can address a range of teaching objectives that include coverage, understanding, motivation (Brown & Atkins, 1988), and higher order thinking/learning, while promoting active participation in the learning process.

## DISCUSSION AND IMPLICATIONS

This paper reported on a preliminary investigation of active learning in IS education. The study sought to address questions on "how might active learning be facilitated in the lecture session" and to assess the effectiveness of active learning in the lecture situation, that is "does active learning really make a difference ?" (CET, 1999). Four teaching strategies were assessed: the traditional lecture, use of visual aids, the industry guest lecture, and interactive class events. Of these four strategies, it is the interactive class event that specifically seeks to foster active learning in the lecture. It was expected that active learning would afford opportunities to think, enhance student motivation, interest, and participation, and provide useful feedback on student understanding.

While the results did not provide strong evidence for the relative effectiveness of active learning as compared to more passive approaches to teaching (such as the traditional lecture and use of visual aids), they did suggest that respondents were distinguishing between active learning events and passive learning mechanisms, in respect of motivation to learn and expected grade. Although the strength and direction of association could not be statistically assessed in the context of this study, qualitative evidences suggest value in combining passive learning techniques (that promote learning by listening and seeing) with active learning events (that promote learning by doing ie. application and thinking).

While these results do not suggest active learning supersede the traditional lecture and other passive learning techniques, there is some evidence of increased enthusiasm for participation in classroom discussions, of students' liking of active learning events, and of its ability to enhance teaching effectiveness in the lecture situation. By participating as a *team*, individuals may also feel more secure and more willing to participate in the discussion, to take risks and test and share the ideas of the team (Davis 1993). Perceived risk to personal efficacy and self-concept may also be minimised, since "Team Think" focuses not on what *I think*, but on what the *team thinks.* Finally, in this study, since teams selected each other or could join the discussion at any time this created opportunities for student control of the participative process, which in turn may be associated with student motivation (McKeachie 1997).

## LIMITATIONS AND FUTURE DIRECTIONS

This study has a number of limitations inherent in context, methodology, instrumentation, and sample size. For example, the small sample size limited statistical testing that could help determine more accurately the strength and direction of the effect of the teaching strategies used. Since interactive class events were used for a very limited time (3 sessions only), this may also represent an inadequate base on which students can accurately assess the effectiveness of particular strategies. There is also some concern that the respondents may not have separated judgements on the effectiveness of the traditional lecture from judgements concerning other strategies (such as interactive class events, use of visual aids, industry guest lecture) used to complement the traditional lecture. This may be reflected in the comment of one respondent on the traditional lecture: '*You made each lecture fun and very interesting. It was enjoyable to attend*" – while encouraging, this suggests that clear distinction between the traditional lecture and other teaching strategies that went together to make the plenary session "fun and interesting" might not have been made. Finally, in an attempt to measure the effectiveness of a particular strategy, student responses may in fact, reflect preference. While it has been the practice of researchers to measure effectiveness by assessing student preference (Hodgson 1997), there is a need for more objective assessments of teaching effectiveness.

Although the results did not yield strong statistical basis for further assessment of the effect of active learning in large class teaching, nonetheless their potential usefulness should not be discounted. Indeed the results suggested that respondents were distinguishing between teaching strategies, although the data was insufficient for further assessment. Further study is needed assess the contribution of these and other techniques (eg. hands-on labs, simulation games) to student learning. This may involve systematic observation, experimental design, and other strategies for data gathering and assessment.

## CONCLUSION

Large classes represent particular challenges to the educator as regards student learning. Despite limitations in the research method, context, and instrumentation, this study suggests merit in using active learning in IS teaching to complement the traditional lecture in large class teaching. By varying student activities during the lecture session, one can help renew attention, generate interest, and provide opportunities for students to think and feedback on student understanding. The successful incorporation of cooperative learning into the traditional lecture may also be the most economic way of improving participation in large classes, while remodelling classroom teaching in a way that meets higher learning objectives (ie., concept use, understanding, and application), improves student learning and retention, increases student involvement in and responsibility for the learning process, and equips students with life-long learning skills. The challenge then that faces the IS educator lies in how to develop, use, and share active learning strategies that work.

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