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ABSTRACT

This paper considers how active learning events in the form of problem solving/discussion events can be combined with the traditional lecture to better support good teaching and student learning in information systems (IS) education. A single case study is used to illustrate and evaluate the effectiveness of small group problem solving and discussion in large classes, for student learning. The results are presented and implications for effective teaching are discussed. The results of this study suggested that problem solving in small groups with follow-up discussion was particularly effective for providing opportunities for students to think, to question, to listen and reflect, to apply concepts, and to learn cooperatively from each other. The study did not suggest that active learning displace the lecture but rather that active learning techniques be used to overcome the limitations of the lecture and enhance the effectiveness of large class teaching. (Contains 14 references.) (Author/AEF)

TEACHING FOR LEARNING IN IS EDUCATION: ASSESSING THE EFFECTIVENESS OF SMALL GROUP PROBLEM-SOLVING/ DISCUSSION EVENTS IN LARGE CLASS TEACHING

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ABSTRACT

This paper considers how active learning events in the form of problem-solving/discussion events can be combined with the traditional lecture to better support good teaching and student learning in IS education. A single case study is used to illustrate and evaluate the effectiveness of small group problem-solving and discussion in large classes, for student learning. The results are presented and implications for effective teaching are discussed.

INTRODUCTION

Much of university education is based on the theory that students will learn if information is transmitted during lectures or if they do things in practicals or seminars (Ramsden, 1992). Although these are not necessarily inaccurate conceptions of teaching, they represent narrow visions of teaching. By contrast, good teaching is viewed as a process of working cooperatively with students to change their current understanding (ie. change the way in which students see and use the knowledge they have); it allows students to actively engage with subject content in a way that is likely to enhance understanding. Ramsden further suggests that enhanced understanding is most likely to occur if teaching methods encourage student activity, problem solving and cooperative learning. Students are then more likely to engage with the material at higher cognitive levels including detailed analysis and understanding.

For teaching to be successful, it is important that teaching conceptions and practice be congruous with the goals of education. In higher education goals are articulated as concept use, deep knowledge and understanding, and application (Ramsden, 1992); in IS education these goals include *concept/use* (comprehension and ability to use knowledge when asked) and *detailed understanding and application* (selection of the right thing and using it without hints) (Davis et al., 1997). The IS'97 Curriculum report further identifies teaching methods such as laboratory work and project participation and presentations involving explanation, demonstration and criticism as congruous with the goals of IS education. Nevertheless, IS education like higher education, is criticised for failing to produce graduates who have achieved the goals and objectives of IS education. The concern then arises *whether IS education is providing the right type of education for the future IS professional.* A goal of IS education is to produce graduates who are equipped to function in an entry-level position in the organisation and who have the basis for continued career growth (Davis et al., 1997). Hence, Lee et al (1995) argue that the IS curriculum must be driven by a clear vision of the career path for graduates. This implies that IS graduates must not only have the skills, knowledge and understanding appropriate to their specialisation, but must also be life-long learners, able to question, to think critically and independently and to learn. If students are to develop these abilities (e.g., to think critically, and reason logically, creatively and flexibly in a variety of new situations) then educators need to examine both how and what they teach (Chalmers & Fuller, 1996).

Studies in IS education have tended to focus on the development of curriculum that meets the needs of industry (e.g., Davis et al., 1997; Gupta & Wachter, 1998) and defining an appropriate balance between technical expertise and business knowledge (e.g., Lee et al., 1995). While educators have recommended useful strategies for IS teaching (e.g., Davis et al., 1997), few have evaluated the effectiveness of these strategies in the context of IS teaching and student learning. Although there are many factors that impact teaching and learning (e.g., context, personal factors, prior knowledge), this study emphasises teaching that encourages active engagement in the large class lecture setting. This study is expected to enhance current understanding of how the lecture setting can be augmented to better support the goals of higher education (and in particular, IS teaching), by evaluating the effectiveness of small group problem-solving/discussion events in the large class setting. Such study is particularly relevant since the lecture setting, despite criticisms, remains a dominant form of face-to-face teaching in higher education.

ACTIVE LEARNING AND THE CONTEXT OF TEACHING IN HIGHER EDUCATION

Higher education utilises the lecture as the main context for university teaching in large classes. While research has determined lectures to be most effective for coverage and transmitting information, (e.g., Bligh, 1998), the lecture is strongly criticised for its inability to readily support the goals of higher education, that is, understanding and the application and evaluation of ideas (Jenkins, 1994). However, where active learning techniques are used, the lecture can be made more effective in terms of retention, transference to new situations, problem solving, and critical thinking (Horgan, 1999). Indeed, Biggs (1991) argues that the more ways in which a student engages in task-related activities, the stronger the learning. While the lecture context traditionally implies teaching as transmission, teaching for learning can be augmented by using mechanisms that actively engage students in the learning process.

Active learning is based on the assumption that learning is by nature an active undertaking, and that different people learn in different ways (Meyers & Jones, 1993); it presumes that students learn best by doing. Active learning provides opportunities for students to talk and listen, read, write and reflect on course content through problem-solving exercises, small group discussions, simulations, case studies and other activities. Biggs (1999) also suggests that active engagement in the learning process encourages the less academic student to employ high-level engagement techniques such as theorization, reflection, applyication, which are more naturally adopted by the more academic student even if the teaching method is more passive.

The following case study illustrates how the passive, less rigid, transmission-oriented environment of the lecture can be modified to encourage more active dialogue between student and teacher (Horgan, 1999) and improve the effectiveness of large class teaching. Providing opportunities for active learning while relevant in many teaching contexts, is particularly relevant in the context of IS education, encouraging students to develop the skills, knowledge and understanding appropriate to their specialisation, and become life-long learners who are able to question, to think critically and independently and to learn.

THE CASE STUDY: USING SMALL GROUP PROBLEM-SOLVING/DISCUSSION EVENTS TO AUGMENT LARGE CLASS TEACHING

Information Systems (IS) Development is a Level 2 undergraduate course. This course focuses on the analysis, design and implementation of business information systems and aims to provide students with a "good start in understanding the development and use of information in organisations through information systems and technology (IST)". IS Development is a practical, team-based activity. Successful IS development requires appropriate subject and business knowledge as well as an active engagement with subject and context, and critical thinking that leads to the creation (or modification) of information systems. IS development, as undertaken by the professional (ie. systems analyst), involves analytical, managerial, technical and interpersonal skills. Helping students to develop the softer skills of IS development (ie. managerial, analytical and interpersonal) is an essential goal of teaching in this subject.

The lecture defines the main context of face-to-face teaching in this course accounting for two-thirds of the direct teacher-student contact time.[1] Although the lecture is useful for presenting and explaining the theoretical framework and guidelines for IS development, for teaching to be effective, students must also engage in learning experiences that enable them to apply concept knowledge and develop the 'softer' skills of problem-solving, systems thinking, communication, and working with others. Such experiences are not easily furthered by the lecture approach as a teaching strategy. It is therefore important that opportunities be created that support active engagement in critical and creative thinking within context and about the business problem being addressed.

In this teaching context the lecture/discussion approach is used create opportunities for student engagement and to enhance the effectiveness of large class teaching. Here the lecturer directs attention to and explains some essential information (ie. teaching as transmission) - this is followed by questions or problem-solving exercises for students to work through individually, in small groups, or as a whole group. Problem-solving is an essential feature of the lecture/discussion approach as used in *IS Development,* and is an important aspect of teaching and of learning (Laurillard, 1997). The problem-solving exercises helps to vary the lecture and renew student attention while engaging "students in thinking about the subject matter in ways that are designed to improve their understanding of it" (Laurillard, 1997). Problem-solving requires students to apply knowledge and principles to new situations as well as test and reinforce their understanding of what they have learned (ie. at the higher level of critical thinking and analysis). Although the lecture/discussion approach is not new, its effectiveness can only be determined by an empirical evaluation within the teaching context.

To ensure that students do not feel overwhelmed in the large class setting, small groups of four persons (also called *buzz groups* or *informal cooperative learning groups*) work together to master the material presented in the lecture and apply concepts (Johnson & Johnson 1994). It is in this context that students share ideas, listen to each other, and critique and reflect on their responses. Approximately 3-5 minutes are allocated for working through the problem. Initial contributions are taken from 2-3 groups selected by the lecturer or by colleagues. After the initial contributions, groups joining the discussion are especially urged to comment on previous responses or propose alternatives. At the end of the discussion, the lecturer summarises the main points, clarifies outstanding misconceptions, and proposes significant alternatives not previously mentioned. Three or more such sessions may be incorporated into the 110-minute lecture session.

EVALUATING TEACHING EFFECTIVENESS: DATA ANALYSIS AND RESULTS

A self-administered survey questionnaire was used to collect data on the effectiveness of the problem-solving/discussion events used in lecture sessions. Of the 120 forms distributed (and 106 forms returned), 102 (85%) were determined useable. The respondents included Computer Science (CS) majors and IS majors (33%), and business-related majors with some IS (67%). While 79% of the class had taken foundation studies in IS, the remaining students (21%) had taken CS-courses only. Of the respondents 64% were male and 36%, female; 69% were European/New Zealanders, 19% were Asian and the remaining 12% were distributed among Pacific Islanders, Africans and other ethnicities. Eighty-five percent of the respondents expected a B-grade or higher.

The following measures were used to assess the study variables:

- *Student perception of teaching effectiveness* was measured on a 5-point scale ranging from "Very Ineffective" to "Very Effective". Respondents indicated the extent to which the lecture and small group problem-solving/ discussion events were seen as effective for their learning.

- *Ranking of Teaching Strategies.* Respondents were asked to identify and rank the teaching strategies they found most effective for their learning.[2] 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.

The results showed that the traditional lecture was the preferred teaching strategy for 65% of the respondents, while small group problem-solving were preferred by 31.5% of the participants. Seventy-one percent rated the lecture as very effective for their learning; 55% rated small groups as very effective.

The data analyses were carried out using SPSS 9.0. A One-way MANOVA test was used to test for significant differences between responses. A median test and a Kruskal-Wallis test were used to test the following associations between student perceptions of the effectiveness of a teaching strategy and expected grade and motivation to learn.

H1a: There is an association between the lecture and motivation to learn.

H1b: There is an association between the lecture and expected grade.

H2a: There is an association between small group problem-solving and motivation to learn.

H2b: There is an association between small group problem-solving and expected grade.

The results of a One-Way MANOVA test provided evidence of significant differences in student responses ($F = 5.607$; $p = 0.02$), suggesting that students were distinguishing between the teaching strategies. The median test provided strong support for accepting Hypotheses H1a and H2a: there is an association between motivation to learn and small group problem-solving ($\chi^2 = 20.742$, $p \leq 0.001$) and lectures ($\chi^2 = 16.102$, $p \leq 0.01$). The Kruskal-Wallis test provided further support for accepting Hypothesis H1a, suggesting an association between small group problem-solving exercises and motivation to learn ($\chi^2 = 14.609$, $p \leq 0.05$). Some support was also provided for Hypothesis H2b: there is an association between small group problem-solving and expected grade (c^2=8.149, p£0.05). Hypothesis 1b was not supported.

Respondents were also asked to comment on the teaching strategies which they perceived to be most effective for their learning. There were 40 comments on the effectiveness of the lecture and 19 comments on small group problem-solving. Student comments provided some support for including small group problem-solving in lectures. Participants indicated that small group problem-solving "*gets people thinking*", provided opportunities "*to apply what we are learning*", "*encourages thought and [is] good for getting different viewpoint*", exposed students to "*real life examples*", "*made you think about what had just been discussed*", and "*made understanding the ideas a lot easier by seeing it practically applied*". Students also commented on "*collective knowledge*" and that "*people can share each other's ideas [and] get improvement at the same time*", and have an opportunity to "*see different viewpoints on the same problem*" (cooperative learning). One respondent also commented that this "*relieves the boredom of lectures*".

Consistent with expectations, lectures were preferred for coverage and explanation ("*Covered a lot of ground and explained important points in detail*"), clarification (e.g., "*Some aspects explained further than outlined in text*", "*Makes it more clear - with people explaining rather than reading it myself*"), providing direction for learning ("*Know where you are going*"), and stimulating interest (*Informative and interesting as well as stimulating*").

DISCUSSION AND IMPLICATIONS

The results of this study suggested that problem-solving in small groups with follow-up discussion was particularly effective for providing opportunities for students to think, to question, to listen and reflect, to apply concepts, and to learn cooperatively from each other. Although the lecture and lecture setting have limitations, the study did not suggest that active learning displace the lecture but rather that active learning techniques be used to overcome the limits of the lecture and enhance the effectiveness of large class teaching. Indeed the results suggested that students were distinguishing between the teaching strategies, and that the perceived impacts were both different and complementary. The small group problem-solving/discussion events in particular, were associated with expected grade and motivation to learn.

In addition to promoting active learning in lectures, the problem-solving/discussion events provide an invaluable opportunity for the lecturer to reinforce main points, to find out more about the quality of student learning and to provide feedback. If students demonstrated a lack of understanding during discussions, this was clarified to help the group (and the class) understand, reflect on, and correct their responses. It was also important that groups felt assured enough to take on the problem-solving tasks without the fear of failure, and that they were willing to participate, take risks, and test and share the ideas of the group (Davis 1993; Ramsden, 1992).

Despite limitations (e.g., context, instrumentation) this case study provides some evidence to suggest that active learning supports higher level teaching conceptions and goals and can be used to effectively enhance IS teaching in the large class setting. Further study is needed to assess the contribution of problem-solving/small group discussion and other active learning techniques to student learning and learning outcomes.

END NOTES

1. Tutorials, laboratory sessions and project work are also a part of the teaching/learning context in this course.

2. Teaching in this course utilised a variety of teaching methods which include the project methods, lab exercises, and tutorials. For the purposes of this study only those rankings and comments related to the lecture strategy and the small group discussions are reported.

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