CLICKERS AND DEEP LEARNING IN A LARGE UNDERGRADUATE MANAGEMENT COURSE?

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Abstract: The idea that clicker technology, a type of electronic polling technology, could have any relationship to students' acquisition of higher-order learning skills is seen by many as highly unlikely, especially in large classes. Nonetheless, that is precisely what the results of this study seem to indicate. In a study of a large undergraduate Management course in Organizational Behaviour (OB) which blended clicker technology use, classroom lecture, and online course management content, students' perceptions of the acquisition of higher-order thinking skills and team-building skills from the integration of these various resources in the course were solicited. Clicker technology, the aspect of the course reported in this paper, was favourably rated for the acquisition of critical thinking skills and problem-solving skills; it was somewhat less so for acquisition of research skills and creative idea generation, and the team-building skills. They also reported a preference for learning with clickers than without and felt its use increased student engagement.

1 INTRODUCTION

Clickers, also known as Audience Response Systems (ARS), have been used in many settings, courses and levels (King and Robinson, 2009; Watkins and Sabella, 2008; Mayer, et al., 2009; Berry, 2009; Morgan, 2008; Trees and Jackson, 2007; Herreid, 2006; Barnett, 2006; Len 2006), but are largely viewed as more useful for acquiring and testing shallow knowledge than higher-order learning (Dangel and Wang, 2008; Radosevich, et al., 2008; Morgan, 2008). The concept of clicker technology takes advantage of an electronic polling system integrated with presentation software, to analyze and display the distribution of results of responses obtained from the input of those responding to multiple-choice or yes/no dichotomous type questions. This would seem to belie any possibility of application to more robust acquisition of knowledge, and of breaking the isolation so often felt by students in large classes.

The study presented in this paper, sought to examine these issues by soliciting students' perceptions of their acquisition of higher-order learning skills, defined as higher-order thinking skills and team-building skills, as a consequence of the integration of clicker technology in a large undergraduate Organizational Behaviour (OB) Management course. The results indicate that students do favourably view the integration of clickers into their course, and perceive that they contribute to their engagement and acquisition of some of the higher-order thinking skills, namely critical thinking skills and problem-solving skills, but less so for research skills and creative idea generation, and for the team-building skills.

2 BACKGROUND

Deep learning can be defined as "the intention to extract meaning produces active learning processes that involve relating ideas and looking for patterns and principles on the one hand (a *holist* strategy - Pask, 1976, 1988), and using evidence and examining the logic of the argument on the other (*serialist)*. The approach also involves monitoring the development of one's own understanding

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(Entwistle, McCune & Walker, 2000)". (Entwistle, 2000, p.2). These are the skills that students are expected to acquire through their tenure in university, and ultimately to take with them into their careers. The issue of how to provide opportunities for this learning in large university classes is quite vexing, as a consequence, universities are looking at if, and how, various technologies might be able to overcome the obstacles posed to this type of learning, and to student engagement, by large classes. (Mayer, et al., 2009; King and Robinson, 2009; Caldwell, 2007; Trees and Jackson, 2007; Barnett, 2006; Herreid, 2006; Hoffman and Goodwin, 2006). Clickers, are one such technology that has been adopted but, as noted previously, are deemed more appropriate for superficial learning. (Czekanski and Roux, 2008; Dangel and Wang, 2008; Radosevich, et al., 2008; Morgan, 2008; Knight and Wood, 2005). The notion of using clickers in a large undergraduate course to encourage deep learning therefore, on the surface, seems ill-advised, or is it?

An investigation of the research literature produces mixed results. Mayer, et al. (2009) found significant improvements in students' exam scores with the use of clickers in responding to discussion questions in large psychology classes over those without use of clickers, and over those without use of either clickers or discussion questions. Watkins and Sabella (2008) on their side found that understanding of questions exhibited in the classroom using the clickers, did not transfer to similar questions posed on the actual exam, whereas Carnaghan & Webb, 2007 and Radosevich, et al. (2008) found better retention scores at the end of the semester. Berry's (2009) study, albeit exploratory, found that their second exam and final course grades were significantly higher with the use of clickers, and that students' satisfaction feedback supported their use. Beckes, 2007 found the technology increased participation and class discussion and was viewed by students as a favourable way to promote active learning. These are just a few of the range of results that research with clickers tends to produce. For succinct summaries outlining the pros and cons from the perspective of students and instructors, as well as best practices recommendations gleaned from their own studies, and that of other researchers, see Medina, et al., 2008 and Nelson and Hauck, 2008.

As the field is still wide open, the study in this paper has focused on students' perceptions of the deep learning and engagement they were acquiring and experiencing with the integration of clicker technology into their undergraduate Organizational Behaviour (OB) course. The possibility of measuring deep learning in any objective way is open to debate (Entwistle, 2000). Additionally, instruments to measure deep learning, often because of their length, are difficult to administer and also to interpret (see Follman, Lavely and Berger, 1997, for a comprehensive inventory of instruments). For these reasons, in this study, the perception of students was used as a surrogate measure. The main instrument used was developed by Thomas, 2001 and has been used in several prior studies on clickers (Morin, et al., 2009; Thomas et al., 2009) and other technologies (Thomas and Morin, 2006; Thomas, 2005 and Thomas 2001).

Deep learning here was defined as higher-order thinking skills such as: critical thinking, problem-solving, research, and creative idea generation, and student engagement was measured by team-building skills fostered, such as: communication skills, work coordination, and team cooperation (Thomas, 2001). These concepts of higher learning are consistent with those advocated by Chickering and Gamson, 1987 in Dangel and Wang, 2008, Facione, 2004, Bloom & Krathwohl, 1956, Anderson & Krathwohl, 2001. These were consistent with the learning objectives set by the instructor for the course, which was for students to be able to: 1) *discuss* the major concepts relating to human behavior in organizations and the interrelationships between these concepts; 2) *evaluate* these concepts critically in terms of their utility, applications, and limitations; 3) *diagnose* and *solve* organizational problems by applying material learned in the course; 4) *communicate* ideas related to organizational behavior, both orally and in writing; 5) effectively *collaborate* on team projects.

The motivation for this study stems from a need, at the university in question, as with many other institutions, to seek cost-cutting measures through larger classes, without jeopardizing the student experience. One teacher will teach a larger group of students with the support of a few teaching assistants offering tutorials which is more economical than multi-sections of the same course to be taught by several instructors. It was hoped that technology, such as clickers, could provide this bridge. Based on the nature of the clicker technology, research skills and coordinating work skills are not expected to be developed with this tool, as no tasks related to these skills is performed with the technology. On the other hand, based on our prior research, it is expected to affect communication skills and collaboration and, especially, problem-solving and critical thinking, while the contribution to collaboration and creative idea generation is expected to be moderate (Morin et al., 2009 and Thomas et al. 2009).

3 METHODOLOGY

The course was presented in lecture format during which the professor gave all information necessary concerning theories of organizational behavior, using PowerPoint presentations, which sometimes included videos and other visuals. The professor also used the i>clicker® system to increase student participation. i>clickers® allow students to try out some questions given by the professor and give feedback to the professor about their understanding of the material which was then used to stimulate class discussion in teams, and as a class. It represents a tool to increase student participation and also provides a way to take attendance, as each clicker has a unique bar code matched with student names. The professor was also available to meet with students by appointment and made good use of the FirstClass® course management system to send announcements to students. All class materials (PowerPoint notes, syllabus, project instructions, etc.) were available on FirstClass®. Lectures were supported by tutorials outside of class-time, given by graduate students who were supervised by the instructor. These tutorials included review of discussion questions.

Students' perceptions of the higher-order thinking skills being developed such as: critical thinking, problem-solving, research, and creative idea generation, and student engagement in team-building skills, such as: communication skills, work coordination, and team cooperation, were solicited via a questionnaire. The instrument was composed of sixteen learning objective questions on a three-point scale - a lot, moderate and not at all, and eight questions on general clicker use on a 4-point scale - agree, strongly agree, disagree, strongly disagree (Thomas 2001). Six relevant questions from the official university course evaluation instrument on satisfaction with the instructional method used in the course were also collected. Five were based on a 5-point scale – strongly agree, agree, neither agree nor disagree, disagree, strongly disagree, and one question on how students rate the course overall was based on - excellent, very good, good, fair, poor.

4 RESULTS

4.1 Demographics

There were 149 respondents from a possible 218 students. Males outnumbered females, 54% to 46%, and the majority were 20-29 years old (72%), with moderate computer experience (64%).

4.2 Students' Perceptions of General Clicker Use

With respect to the distributions of general perceptions of clicker use, on a 4-point scale - agree, strongly agree, disagree, strongly disagree, most students agreed, or strongly agreed, that the use of clickers in the course contributed positively to their learning experience. The first four questions were given this rating by 77%, 86%, 71%, and 77% of the students, respectively. Eighty (80) percent thought there was the right amount of use of the technology in the course, 88% had a positive view of its contribution to their learning, and 94% felt it was used to give immediate feedback to students. The majority, 76% preferred learning with clickers.

4.3 Students' Perceptions of Deep Learning and Engagement

The distribution of the learning objective questions were given on a three-point scale - a lot, moderate and not at all, and the means column and standard deviations were calculated by assigning a score 1 to 'A lot', a score of 2 to 'Moderate' and a score of 3 to 'Not at all' and taking the average. By combining the frequencies corresponding to 'A lot' and to 'Moderate', the percentage of students who thought the clickers had a positive impact were calculated.

Most of the students had a positive perception of the contribution of clickers to their development of critical thinking and problem-solving skills, 72% and 65%, respectively. They were approximately evenly split in their perception of the contributions to creative idea generation, 50%, and to the team-building skills – communication skills, 46%, coordinating work, 47%, cooperation among students, 45%. They were not at all convinced of its contribution to developing research skills. Only 32% felt there was a contribution.

Students had positive perceptions of the class discussions that ensued following the question and answer sessions with the clickers, only research skills was still somewhat lower at 52%. Critical thinking skills and problem-solving skills was again the highest at 85% and 79%, respectively. Creative idea generation was positively perceived by 67%. The team-building skills were in the 58- 64% range.

4.4 Student Perceptions from Course Evaluation

Responses from questions posed to students on the university course evaluations were also analysed. There were 111 complete course evaluations from a possible 218 students. Students felt they learned a great deal in the course and that the instructional method, which included the clicker technology, was effective and encouraged student engagement. Mean scores closer to 1 indicate more favourable perceptions. They also indicate, with means of 2.11, that learning in a large lecture format, augmented with tutorials and clickers, was as effective as courses with smaller class sizes, and would recommend this format over smaller classes to fellow students. From a range of 1, being Excellent to 5, being Poor, the perception of the overall course produced a mean of 2.37.

5 DISCUSSION

The results of this study are in line with those observed in similar previous studies (Morin et al., 2009; Thomas et al., 2009; Berry, 2009; Beckes, 2007). Clickers are, once again, shown to be favourably viewed by students as supporting the aspects of deep learning associated with critical thinking and problem-solving skills, with less support seen for research skills and creative idea generation, and student engagement in team-building skills in general. This favourable view is enhanced, across all the learning objectives, with the classroom discussions with peers, and as a class, which stemmed from the post-polling results displayed from the use of the clickers. This increase was by as much as 13-20 percentage points, the most marked increase being in the perception of research skills support, 20%, which is interesting. Further, most students perceived benefits to learning in general, and to student engagement, from the use of clickers, and preferred learning with them. They would also encourage students to take the course in this large class-size format, with tutorials and clickers, over smaller classes without them. Overall then, clickers are viewed as a positive contribution to the learning experience.

6 CONCLUSIONS

It is clear from the results of this study that clickers have a role to play in large classes, and in fostering deep learning and active student engagement, especially when combined with subsequent discussions with peers, and the class. Evidently, the learner-centered approach to integration of technology per Mayer (2001) is the distinguishing factor. Success depends on the ability of the technology to support students' cognitive processes, and by the instructional method employed to take advantage of these, and not by any inherit merit of the technology, in and of itself. Further research continues to be needed in this area. The marked improvement to the perceptions of support for research skills acquisition when clicker polling is coupled with subsequent class discussion is particularly intriguing. It also would be interesting in future research to link students' performance in the course to their perceptions, along with the instructors' perceptions.

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