Technology Support for Collaborative Learning

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INTRODUCTION

Collaborative learning is an activity that takes place between a teacher and a learner, between learner and learner, and sometimes, one would hope, between learner and teacher. The free flow of ideas between the various parties can be inhibited by a variety of factors, including perceived or actual power barriers, language skills, previous learning experience, and personal factors such as shyness or dominance. Technology can be used as a way of overcoming, or reducing, some of these inhibitory factors, and this chapter outlines some of the computer-based technologies that can be used. The use of technology to support distant learners is well documented, and this chapter concentrates instead on the less well-reported use of technology in the face-to-face classroom. The chapter opens with a brief consideration of collaborative learning and then focuses on the technologies that can be used to support collaborative learning process in a variety of time and place settings. These technologies include audience response systems, electronic meeting systems, and more recently, and rapidly developing, blended versions of these technologies.

COLLABORATIVE LEARNING

Collaborative learning can be considered to be an educational activity that involves two or more students working together in such a way that they can utilise their joint resources, skills, and knowledge to achieve a common educational goal. The goal may be a directly measurable outcome, such as a document, or embodied in the actual process of collaboration itself, in which case a useful definition of collaboration is that it is "… a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem" (Roschelle & Teasley, 1995). The learners can work in pairs or in larger groups, with five or six members being typical, with the most effective interaction being obtained with pairs. This sharing of learning can assist the discussion and sharing of meaning and has been argued to support higher levels of thinking (Johnson & Johnson, 1986) and to develop critical thinkers and greater retention of learning (Totten, Sills, Digby, & Russ, 1991). Although typically associated with assignment work, collaborative activities can be incorporated into more traditional learning environments such as lectures. For example, Rosenberg, Lorenzo, and Mazur (2006) discuss the role of peer instruction (Mazur, 1997) in science classes as a vehicle for improving students' conceptual understanding of course materials. The approach makes use of mini-lectures interspersed with tests that are built around individual consideration of a question, followed by a period in which students discuss their views with a neighbour after which formal feedback is given to the instructor. The process provides for collaborative activity between pairs of students, then between all students, and also enables the instructor to be part of the learning process and to adjust pacing of subsequent mini-lectures or repeats of previous materials. Involving students in evaluative judgements relating to their own work and that of their fellow learners is an essential part of the process of higher education and in lifelong learning (Nicol, 2006).

TIME AND PLACE DIMENSIONS OF COLLABORATION

Collaboration may take place in a variety of spaces that can be characterised by reference to the time and place of the activity (DeSanctis & Gallupe, 1985). Web-based delivery systems, for example, may be located in the different time/different place, or asynchronous, learning space. If video and/or audio conferencing or "chat" facilities are utilised this would occupy the same time/different place (synchronous) sector and different time/same place could be represented by course home pages, wikis, blogs and so on. These spaces are currently commonly used but the same time/same space (face-to-face, or F2F) tools are currently less common and these form the main focus for this chapter. The first technology outlined is the audience response system (ARS).

AUDIENCE RESPONSE SYSTEMS (ARS)

This technology is also known by a variety of aliases, including electronic voting systems, classroom communication systems, classroom performance system, and personal response systems. The basic technology comprises a hand-held input device (keypad) that communicates with a receiver via an infrared or wireless link. Software on the classroom PC is used to display questions or statements and students are invited to use their individual keypads to respond. The response data is aggregated and displayed in a variety of forms on a public screen via a data projector. The software is usually embedded in PowerPoint™ and is simple to use. The system may be set up temporarily each time it is used or may be permanently installed in a room, for example, a large lecture theatre. Keypads may be provided by the institution or bought by students. The systems can be used with groups with as few as five members (Banks, 2006) or with groups up to several hundred.

At first glance the use of a basic numeric keypad may seem to limit the use of the technology to simple response to multiple choice or similar question structures and only support surface learning this is far from the case in practice. The technology certainly can be used for in-class tests and offers the benefit of instant feedback to students, but it can also be used to support a variety of teaching and learning approaches. Greer and Heaney (2004), for example, use this technology to explore quantitative problems, applied reasoning, creative thinking, and "popular misconceptions of science" sessions in their introductory Earth science course. They link images to their presentation, with students applying their understanding of the laws of superposition and cross-cutting relationships to the interpretation of a rock formation image. An exploration of issues surrounding personal decisions by medical personnel was supported by an ARS in work carried out by Freeman and Dobbie (2005). The ARS was used prior to a lecture to obtain views from the participants about ways in which they would react to given situations, and the aggregated views were displayed on the public screen. This ARS session was then followed by a 20-minute lecture, after which the participants were asked to answer the same set of questions, again using the ARS. It was felt that the anonymity offered by the ARS was of considerable value, and that the sharing of colleagues views was helpful, and that the whole process was stimulating and enjoyable. Schackow and Loya (2004), also using ARS in the medical area, reported that ARS-enhanced lectures improved post-lecture performance and factual retention in family medicine residents both immediately after the lecture and up to one month after the lecture. Examples of the use of ARS in a wide range of subjects including mathematics, agriculture, liberal arts, engineering, philosophy, and ethics. In each case, the focus is upon learning goals rather than marks or grades. Using step-by-step learning structures with increasing levels of difficulty at each step accompanied by constant and immediate feedback to the learners can increase confidence and motivation.

As the cost of the technology continues to fall, one would anticipate a higher adoption rate for ARS. The adoption of ARS is now widespread in universities around the world, and those institutions that have used them are tending to expand the range of courses they are used with. For example, Wong (2005) reports that Purdue installed the technology in 215 of its 276 classrooms in its West Lafayette campus, with over 6,000 students using the technology and an anticipation that the usage will eventually extend to as many as 20,000 of the 38,000 students enrolled.

Positive benefits in the use of ARS:

- Creates interest in topics that are not normally exciting for learners (Banks & Bateman, 2004; Freeman & Dobbie, 2005);
- Generates improvements in retention and test scores (Schackow & Loya, 2004);
- Helps students to gauge their level of understanding of course material and reinforce concepts provided in the lecture (Greer & Heaney, 2004);
- Time savings in automatic grading and recording of scores allows quizzes to be given more frequently (Petr, 2005);
- Enhances student confidence and the perceived benefits of learning (Nicol, 2006); and

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