Student Feedback in the College Classroom: A Technology Solution

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Technology in the university classroom has made great strides in the area of presentation of materials. Ceiling-mounted projectors and media carts with projection capabilities have made the multimedia classroom presentation a routine event for much of the world of higher education. Now there is technology that permits the instructor to solicit student responses during class via wireless keypads. This allows all students to respond simultaneously and the instructor to know the results immediately. This article reports the results of a pilot study on student reaction to a specific system (LearnStar). Students were uniformly positive in their appraisal of this technology as a teaching tool.

The past 15 years have brought about significant technological achievements that have had great impact on the higher education classroom. A well-equipped classroom today contains projection equipment that permits the instructor to display computer-based instruction materials (such as Power Point®), have access to the Internet, play videotapes, and use a projection panel to display print material and show details in close-ups of three dimensional models. This capability has dramatically enhanced the means by which classroom presentations are made.

Presentation, however, is only a part of the learning process. It is important for instructors, particularly in larger classroom settings, to get feedback from students as to the extent to which the material is understood. The traditional method of checking student understanding is to ask a question. Generally a few hands will be raised and a student will be called on to answer. The instructor gets only one response, which may or may not be representative of the class as a whole. The instructor often does not know the extent to which the material is learned by the class as a whole until there is a formal test.

Recently, technology has emerged that allows students to respond individually, through a keypad, to an instructor's questions during class. The instructor can know immediately the responses of all students through a display on the computer. This creates possibilities for instructor-class interaction that have not been feasible before. This article presents the results of a pilot study using this technology in a university classroom.

INTERACTIVITY IN COMPUTER-BASED INSTRUCTION

The importance of student interaction has been strongly stated in studies involving computer-based instruction. James, Lamb, Baily, and Householder (2000), in a project involving applications of technology to teaching science, mathematics, and technology, stated that strategies for improving instruction should include "active learning environments" (p. 29). Milheim (1995) stated that "interactivity is one of the most important factors in the design and development of effective computer-based instruction materials" (p. 225). In a review of the literature, Milheim suggested that interactive learning heightened student interest and improved higher cognitive learning, and that interaction may be the most important factor in computer-based instruction.

Borsook and Higginbotham-Wheat (1991) suggested that interactivity was a critical aspect of computer-based instruction. Pritchard, Micceri, and Barrett (1989) indicated that interactivity is a key element in computer-based training (CBT). "We believe that the dynamics of the human-computer interface are crucial to the success of any CBT package" (p. 19).

Berge (1999) indicated the importance of building interaction into Web-based materials and suggested that it requires a reorientation of the instructor's approach to learning. "In general, the difference between the transmission model and the constructivist and interactionist frameworks is that the former is highly teacher-centered and the latter are student-centered approaches to learning and teaching" (p. 7). In brief, the *transmission* model of learning is based on information being transmitted from teacher to learner while the *constructivist* model suggests that that learning takes place best when constructed within the framework of the learner's own understanding. The *interactionist* model suggests that learning is the result of interaction between the learner and the learner's environment. As Berge indicated, the movement is away from simply transmitting information (teacher centered) to understanding and incorporating the learner into the process (student centered).

Interactivity has been found to be important in distance learning settings (Egbert & Thomas, 2001; King & Doerfert, 1996), particularly when it helps understanding by providing immediate feedback to errors (Notar, Wilson, Restauri, & Friery, 2002).

Other educational technologies also feature interactivity. Cronin (1993) found that interactivity was a critical feature of applications of the videodisc to learning.

Milheim (1995) stated ". . .interactivity can be defined simply as the two-way communication that occurs between learners and the education materials that are presented during an instructional lesson" (p. 226). All of the above studies discuss situations in which the primary interaction is a response from the technology, or between the learners and the education materials. In summary, it can be concluded that there is convincing evidence that interactivity is a critical part of any form of technology-based learning.

INTERACTIVITY IN THE CLASSROOM

Much of higher education, however, is still classroom based. If interactivity is a critical part of technology-based education, then interactivity should be considered a critical component of classroom presentation of a lesson. Many instructors generate class interaction by asking questions. Supposedly, this stimulates the students to consider answers and respond. In action, however, usually only a small number of students answer questions consistently. The rest of the class listens while one of those persons responds. This article will discuss the results of a pilot study of the use of a new technology that permits each member of the class to respond simultaneously to a question presented by the instructor.

Current Technology to Promote Classroom Interaction

This article discusses a product for classroom interactivity called LearnStar. However, LearnStar is only one of a growing number of products with the capability of permitting students to respond simultaneously to an instructor's question. Earlier interactive

technology devices employed individual units for students that were wired to a computer, such as Classtalk (2003). Now the basic configuration includes individual units that transmit responses to a receiver that can be attached to a standard computer. Two systems that are comparable to the one discussed in this article are CPS (Classroom Performance System, 2003) and PRS (Personal Response System, 2003). The Website for current specifications and pricings can be found at their Websites, http: / / .einstruction.com for CPS and http / / :educue.com for PRS.

LearnStar: Real-Time Class Interaction

LearnStar is a device that permits students to respond simultaneously to questions through individual keypads. The keypad transmits responses to a receiver that is attached to a standard computer. The system is installed by a company representative, and a training workshop of approximately two hours is provided by the company. A full description of the system can be found at www.learnstar.com. The system has an editor that allows the instructor to generate questions. Multiple-choice or true–false answer formats were chosen because the response for those formats requires only one key. However, questions can require short answers because longer responses can be entered from the keypad. A typical question format might be How many bones make up the middle ear ossicular chain? The question is presented on the screen for 10 sec and then the possible answers appear, in this case (a) 1 (b) 2 (c) 3 (d) 4. Students have 10 sec to select an answer. The correct answer is then displayed and the results can be disclosed immediately after the answer period.

The questions are presented to the class as a whole by means of a classroom projection system. The students select an answer via the keypad, which transmits a signal to the computer, which registers the response for each individual. The duration of time the question is displayed and the duration of time the student is given to respond are set by the instructor. The results can be displayed on the screen immediately after the completion of the responses.

A pilot study was designed to examine the feasibility and suitability of the LearnStar system for use in university classroom. The LearnStar company representatives indicated that at the time this study was undertaken, no other institution of higher learning was using the technology. Currently, Texas Tech University is designing LearnStar materials to be an integral part of the studies in the college of science and mathematics (Blake, 2002).

METHOD

Setting

The study was conducted in a classroom used by the Auburn University Department of Communication Disorders. The room is also the laboratory room for the department and contains models and anatomical dissections. The room has media capabilities to support LearnStar in terms of a ceiling-mounted projector and a teaching console for projecting computer, video, audio materials, and a camera for viewing documents and small objects.

Subjects

LearnStar was tested in two courses. CMDS 3400 is entitled The Speech and Hearing Mechanism and is a heavy content course in the professional sequence for majors in communication disorders. This class had 31 students enrolled. The students are typically sophomore or junior level, ages 20–25.

CMDS 2500 is entitled Communication Disorders in Society and is a course for nonmajors that acquaints students with the various communication disorders (how to recognize different communication disorders, how it feels to have one, and how to interact effectively with persons who have them). This class had 39 students enrolled. CMDS 2500 is a university elective course that is taken by students ranging from freshman to senior, with a variety of majors, and encompassing a wider age range.

Materials and Procedures

The materials were drawn from a bank of questions developed by the instructor over several years. LearnStar includes an editor that permits the instructor to write original questions and general multiple-choice answers, and provide a tag screen after students have responded to a question to include additional or supplemental information. The scoring is instantaneous and the results can be projected on the screen immediately after the question is completed.

Presentation Format

The format for presentation is as follows:

1. The question is presented on the screen. The students have a set amount of time to read it before the screen changes (the time is keyed in by instructor when the questions are entered).
2. Next, the question and the answers appear on the screen. Students are given a set amount of time (instructor determined) to select the correct answer.
3. After the time for viewing the question and answers elapses, a counter begins to count down. The instructor started it at 1,000, but any number can be programmed. The countdown time was set to nine seconds, but could be set to any time. Nine seconds was chosen because it seemed to have the best balance (not too long, not too short) for student responses.
4. Each student keys in an answer. If the correct answer is entered before the counter starts counting down, the keypad will be credited with 1,000 points.
5. As the counter counts down, incorrect answers are "wiped out." If a student sees that the selected answer was incorrect, the answer can be changed. When the correct answer is entered, the student's keypad is then credited the number of points less than 1,000 that the counter had reached.
6. The correct answer is displayed on the screen along with a tag line. The tag line provides additional information. For example, the question might be: How many bones are in the middle ear? to which the answer would be three. The tag line might add: The bones of the middle ear are the smallest bones in the body.
7. A summary of each keypad (for purposes of this study, identified by number only) is then projected on the board so students can compare their performance with that of the rest of the class.
8. Results are stored on the computer and reports can be generated from the data at the instructor's convenience.

A complete demonstration of graphics and detailed demonstration of the product can be seen at www.learnstar.com.

Survey

Students were given a survey to determine reactions to the use of LearnStar in the classroom. Each question was phrased to determine whether or not there was a positive response to different aspects of using LearnStar. A five-point scale was used, with 5 being a response of *Strongly Agree* and 1 representing *Strongly Disagree*. Each question was phrased so that *Strongly Agree* represented a positive reaction to the project; for example, Question 1 was: I enjoyed using LearnStar in the class.

RESULTS

The complete results of the survey are attached as Appendix A. Of 39 students in CMDS 2500, 31 completed the survey, and 24 of 31 students in CMDS 3400. A bar chart of the results was constructed for each course to break the survey responses into three categories: Agree, No Opinion, and Disagree. The Agree category combined both the *Strongly* and *Moderately Agree* choices, and the Disagree category combined the *Strongly* and *Moderately Disagree* categories. This provided a simple breakdown to indicate whether or not students basically liked or disliked the activity. The Agree bar represents positive reaction, the No Opinion is self-evident, and the Disagree bar represents negative reaction. These are presented in Figures 1 and 2.

Figure 1 ☐ Grouping of responses of students to a survey of their reaction to the use of LearnStar in the classroom, CMDS 2500. Questions are contained in Appendix A.

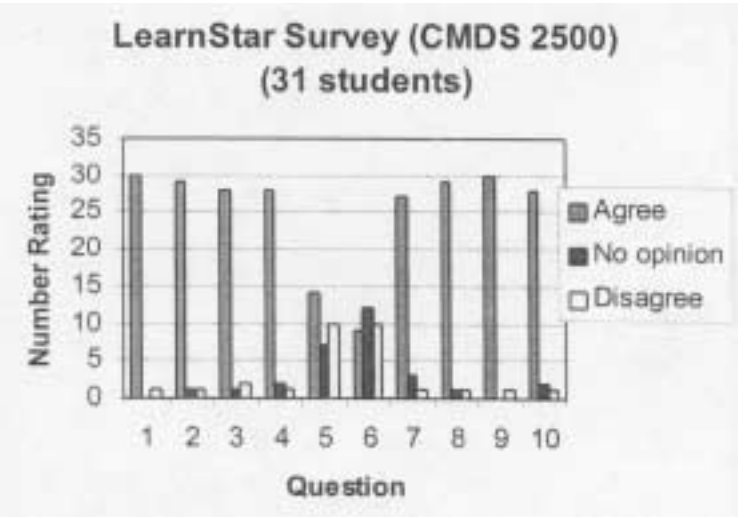
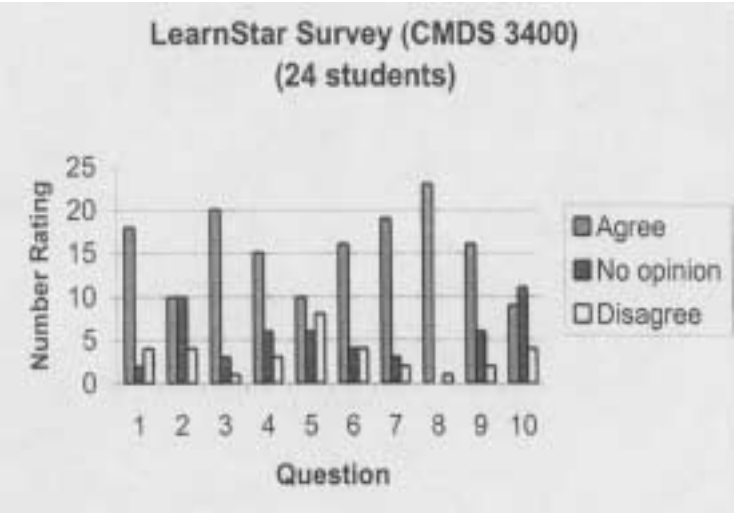


Figure 2 ☐ Grouping of responses of students to a survey of their reaction to the use of LearnStar in the classroom, CMDS 3400. Questions are contained in Appendix A.



The charts suggest that both classes had a positive reaction to LearnStar, with the course for general studies having a more strongly positive response. In that class, however, there were two questions that did not follow the general trend. The first, Question 5, was: I prepared more for class knowing LearnStar would be used to test my knowledge of the subject. Both classes had a neutral reaction to this question, perhaps because the classes were told from the beginning that this was a pilot test of LearnStar and that their responses would not be used in calculating their grade. The second question, Question 6, was: I told my friends about using LearnStar in the classroom. More students from the professional studies group indicated a posi-

tive response to this question than did the general studies group.

Instructor's Reaction

This is a project that requires considerable preparation. However, once prepared, the material can be used repeatedly with little maintenance. I think the basic advantages of LearnStar are as follows:

1. The activity promotes focus. I used the questions for reviewing the material from the previous class meeting. I was, and still am, struck by the attention the students paid to the material. Everyone in class was watching the screen, poised over the keypad. I limited the use to 10 questions per class (about 12 min of class time). One of the reasons I continue to use it in this fashion is that I found that the focus generalized to the rest of the class. After using LearnStar, they were more attentive to the materials presented in the rest of the class.
2. The activity not only provides feedback for the student, it provides feedback for the instructor. As instructor, I could see what material they understood and what problems existed. I caution anyone who uses this, though, to be prepared for less than stellar scores. I found that there was a lot of misunderstanding of material that I would have assumed they knew. With LearnStar, material that needs to be clarified is quickly identified.
3. The students are likely to get to class on time. Once the activity has started, the individual coming in late cannot join in. Some students started asking me if we were going to use LearnStar in the next class. When I questioned why they were asking, they said they wanted to make sure they got to class on time if we were going to use it.
4. The student enjoy it. An analysis of the comments from the survey (included in the Appendixes) indicates that most complaints were of a procedural nature; for example, the question was not presented long enough, the keypads were not always functional, and so on. Once those problems were addressed, there were no significant negative comments.
5. I now use the live poll feature when reviewing study questions for tests. This function permits the student to vote in real time. After the students vote, the instructor presses a key and a graph, (such as a bar graph) is displayed on the screen. Students can see how the class has voted, and the instructor can tell when there is confusion on a question. There is no screen presentation of the question; the instructor simply reads a question and asks students to respond.

Several other controllable options and variables in LearnStar were not discussed in this article. The degree of flexibility and ease of editing add significantly to the overall usefulness of LearnStar.

CONCLUSIONS

A review of the comments suggests that there were several problems initially. First, 10 of the 40 units did not work properly and eventually were replaced by the company. After the initial defective ones were replaced, all units worked properly throughout the semester. This suggests that all units should be thoroughly checked on installation.

A second problem was the timing, which was the result of my programming. For a time the program was set to present the questions too quickly for the students' comfort. This was adjusted when it became evident that it was a problem. There were no negative comments after the final adjustment. Interestingly enough, the preferred timing was specific. Nine seconds was acceptable; 10 seconds was too long; and 8 seconds was too short.

No statistical comparison was made with previous classes as to grades or performance on previous tests, because it was thought that there were significant variables that could not be controlled. Analysis by the instructor suggested that there was not a significant difference in the grades of the classes using LearnStar. It should be remembered that LearnStar was used for only a limited amount of the class time.

In a discussion of the changes brought about

by technology, Miller (1995) referred to "Socrates' laments about the destruction of memory by writing" (p. 608). Learning by oral discourse is preferred because the listener has to retain the information (rather than rely on a written document) and because the listener can question (interact with) a speaker, whereas text is static. This supposes that the teacher-learner ratio is such that learners have the opportunity to interact. Such is often not the case in higher education today where class numbers severely restrict opportunities for interaction.

Borsook and Higginbotham-Wheat (1991) stated, "It appears that the richness of human-to-human interactivity is a goal for which computer-to-human interaction should be striving" (p. 16). Perhaps technology can provide the mechanism for increasing the amount of human-to-human interaction in the classroom.

Schroeder (1993) indicated that the new generation of learners has diverse learning styles. The author suggested that the current generation ". . .prefer[s] a high degree of personalism" and ". . .need[s] frequent feedback on their performance" (p. 25). Schroeder suggested the traditional lecture-style presentation is not well matched to the learning styles of today's students. Again, perhaps technology can create new avenues of interaction that will meet the needs of a changing student population. □

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Appendix A overleaf