A Framework for the Study of Technology Supported Education

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Teachers must select both content for their classes and the level of technological support they will use to deliver it. The use of technology in the teacher/learning process has infiltrated nearly every level of education with the support of both teachers and administrators. The value of this revolution is uncertain. Research results are mixed. Part of the difficulty in interpretation is the lack of a framework to categorize existing results and direct future efforts. This paper proffers such a framework. The framework evolved from the simple communication model. The framework describes three dimensions in the process; teacher, student, and message. The various activities contained in each dimension are described by the tasks they contain. The paper also describes where technology can be applied.

Literature Review

In today's world, teachers must select both the content for their classes and the level of technological support they will use to deliver that content. A teacher can choose from a myriad of options from limited technological support of more traditional teaching methods to the delivery of technologically enhanced class material through two-way interactive audio-video (Anderson, Banks, & Leary, 2002). Each month new articles describe the technology revolution in the classroom, and all of the benefits therein (see Bell, Davis, & Linn, 1995 or Owston, 1997). Everyone from "techno-geeks", to accrediting agencies, to academic administrators seems to defend the revolution of technological support for education (Foshay & Bergeron, 2000; Mariola & Manley, 2002).

Is the revolution a good idea or just another case of infatuation with technology? Will this technology lead to improvements in teaching or learning? Are the applications of technology in education sound investments or attempts to find uses for some really cool new toys? The answers are benefits to the teaching/learning processes that technology might generate. Identified benefits include increased learning (Driver, 2002), increased student and teacher satisfaction (Anderson, Banks, & Leary, 2002), and increased availability to students (Keegan, 1990). However, results vary as to the degree or even existence of these benefits (Zhao, 1998). One of the main reasons for this lack of agreement is the lack of an organized approach to studying the phenomenon.

The literature surrounding technology supported education is abundant, albeit inconsistent (Foshay & Bergeron, 2000). The field presents as many approaches as authors. A descriptive framework is required to both integrate existing research and direct future efforts. This paper proffers such a framework.

Simple Teaching Model

The basic model of communication describes a process of a sender transmitting a message through a medium to a receiver (Figure 1). This process can be as simple as speaking with someone in the same room to computer generated, encrypted signals transmitted via satellites. Communication is said to occur when the receiver not only accepts the message, but

also understands the intended meaning. For example, someone creates an opportunity to communicate by speaking to you. However, if they use words you do not understand, speak too quickly, or use a language you do not know, then you can say you received a message, but did not communicate. Even when the receiver understands every individual word of the message, but does not understand the intended meaning of the message, communication does not occur.

Figure 1. Simple Communications Model
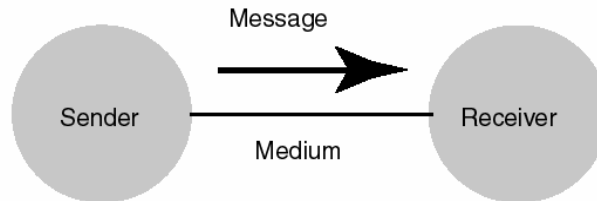
Teaching is a special form of communication. Traditionally, teachers and authors create messages and transmit them through lectures, printed pages, writings on boards, etc. Students receive the messages attending classes or studying. Then the pattern is reversed and students generate messages (e.g., questions, discussions, exams) to be sent to teachers. At some point the teacher evaluates the amount of communication (learning) that occurred.

**Figure 2. Basic Teaching Module**
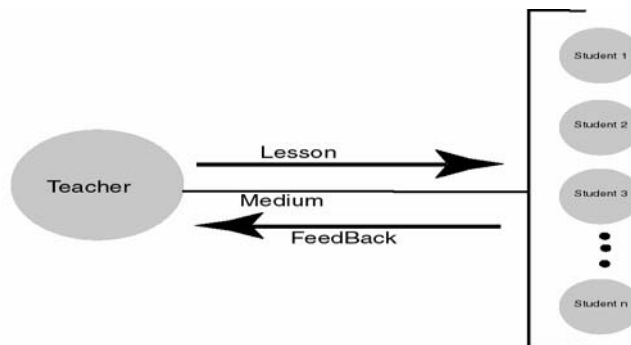
Since education is a type of communication we can apply this basic model with only a few simple changes to the process of teaching/learning (Figure 2). The first change is to rename the important components. The second model substitutes teacher for sender, student for receiver, and lesson for message. Secondly, the model requires two minor adjustments. The first is an additional communication link, a feedback channel, that allows students to communicate with the teacher (e.g., exams). Secondly, the model allows the possibility of involving more than one student in the communication process (i.e., more than one student in a class).

The basic model presents three dimensions of the teaching/learning process (Figure 3). The first dimension includes four basic teacher activities: lesson generation, lesson maintenance, student evaluation, and class administration. Lesson generation has historically taken the form of

lecture notes. However, it encompasses all of the tasks required to prepare the knowledge that will ultimately be disseminated to students. These tasks include, but are not limited to, information gathering (e.g., reading texts, internet searches, conducting research, reviewing research) and selecting student materials (text, readings, internet sites, etc.). Lesson maintenance deals with the flow of the class. The focus here is on chunking the information, creating lesson plans, planning class activities, and preparing lessons for delivery (lecture notes, handouts, overheads, videos, etc.). Student evaluation consists of measuring student learning, or at least performance. These tasks include creating, administering, and scoring all student work. Furthermore, the scores must be recorded, stored, and shared with the students. The final activity in the teacher dimension, class administration, is made up of many of the tasks that seem to get in the way of teaching, but actually support the communication of knowledge process. This activity contains tasks such as maintaining class rosters, syllabi, reporting scores to administration, taking attendance, group assignment, and maintaining a class website.

Figure 3. Research Framework
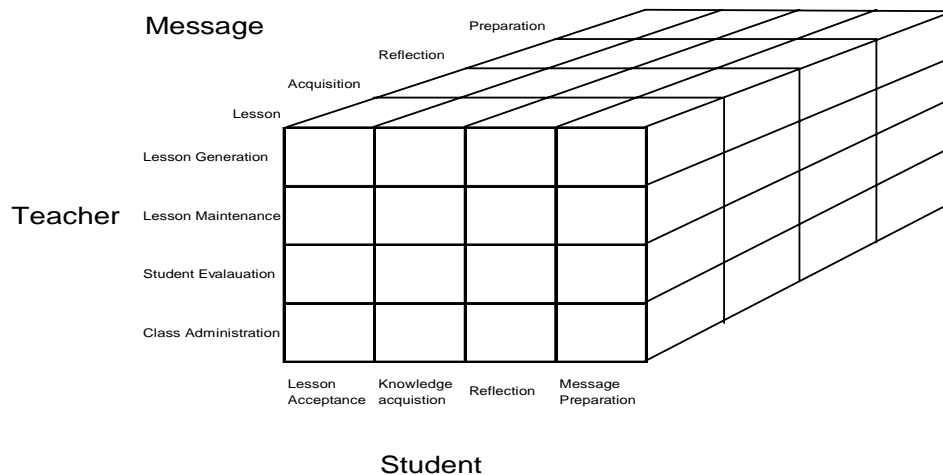
The second dimension includes four student activities; lesson acceptance (which requires lesson reception), knowledge acquisition (learning), reflection (studying), and message preparation. Lesson acceptance is the student understanding the lesson. Tasks in this activity include listening to lectures, taking notes, and reading texts and other material. Knowledge acquisition is the accumulation of lessons and their assimilation with the student's previous learning. Reflection occurs when the student studies, generally as preparation for an exam or class assignment. Finally, message preparation occurs when students organize what they have learned so that they can submit something to the teacher for evaluation, ask a question for clarification, or prepare any other message for the teacher or other students.

The final dimension is message delivery. This model allows for the exchange of four types of messages; lesson, class administration, evaluation, and participation. Lesson and class administration messages originate from the teacher. The lesson messages are the content of the class. They contain the information the teacher wants to convey to the students about the subject matter. Class administration messages address all other communications needs from teacher to student. Examples of these communications include tests, test results, assignments, and syllabi.

The remaining two messages, evaluation and participation, originate with students and are directed to the teacher. Evaluation communications consist of exams, quizzes, papers, and class presentations. Participation messages address all other student communications. Examples of participation are asking/answering questions, teacher evaluations, and seeking help or clarification. The next section describes the application of technology to support these activities.

Application of Technology to the Teaching/Learning Framework

Humans apply technology to enhance our abilities to do things or to enable us to do things we would otherwise be unable to do. This section describes instances of where technology has been, or could be, applied to the teaching/learning process. The ultimate goal is to improve learning, with the understanding that improved teaching leads indirectly to improved learning.

A review of the four activities of the teacher dimension reveals many opportunities to implement technology. A variety of technologies, such as internet searches, on-line publications, discussion groups, and news searches support lesson generation. Researchers have studied the effect of technology in lesson maintenance by looking at the approach of the course (instructor vs. student-directed learning) and the motivation and training of the instructor, and team vs. individual instruction (Foshay & Bergeron, 2000). Zhao (1998) looked at the effects of technology on such things as difficulty of material, preparation or maturity of students, and amount of material to be covered. Student evaluation has been improved with test databanks, electronic grading, and on-line grade books. Class administration can be improved through on-line syllabi, electronic recording and transmission of grades, and class web sites.

Student activities cover those issues that affect actual learning by the students. One group of issues address the benefits students gain from the technology in terms of amount learned, the speed of learning, or satisfaction with the process (Driver, 2002; Bishop, 2002). A second group covers the effects of individual differences in learning styles and motivation (Astleitner & Leutner, 2000; Larson, 2002). The third group covers measurement issues that primarily deal with measurement of learning but also include many individual and group measurements such as satisfaction, motivation, social presence and degree of social independence (McLoughlin, 2002; Tu & McIsaac, 2002).

Technology is often used to support the exchange of all four types of messages. Teachers use technology like courseware, email, list serve, chat rooms, and web pages. They also use broadcast and two-way interactive audio and video (Foshay & Bergeron, 2000; Zhao, 1998; Anderson, Banks, & Leary, 2002). A second area of research in technology supported education combines delivery techniques or the degree to which the technology is employed. That is, the effectiveness of combinations of technology and more traditional delivery (Kanuka, 2002; Sims, Dobbs, & Hand, 2002; McLoughlin, 2002).

Conclusion

We have applied technology to almost every aspect of life for thousands of years. Using technology can lead to improvements in task performance, but we must be cognizant of the fact that technology often changes the nature of the task. Furthermore, changing one task in a system is likely to create unanticipated changes in other parts of the system.

The literature clearly presents successful attempts to apply technology to the teaching/learning process. The fact that the results are inconsistent and sometimes contradictory is probably due the inconsistent manner in which technology has been applied. A conceptual framework will help with these inconsistencies by indicating appropriate dependent,

independent, and control variables. This will allow us to compare results across studies and will ultimately lead to an organized body of knowledge.

Finally, we need to look for opportunities to re-engineer the teaching/learning process. We assume a great many "givens" in this process. These include the traditional notions of a classroom, three hours per week, fifteen weeks per semester, lectures, exams, and so on. Perhaps more a holistic examination of the entire process will reveal sub-processes than can be combined or eliminated as well as entirely new approaches to the more traditional, time honored methods.

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