A Study in Use of Technology in Distance Education and On-line Learning

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Introduction

With the advent of the Internet online/distance education gaining popularity, everyday more and more colleges are introducing new online courses. Computer and telecommunication technological advances have provided alternatives to the traditional classroom setting. Technology and interaction software are the basic blocks of the online courses. While distance education and online learning overcome many barriers and allow learners and educators many new opportunities over the traditional education, it also introduces many shortcomings and challenges.

This paper will review different studies regarding communication, distance education and the use of technology in online courses. It will focus on technology issues in the area of interaction and communication. The processes involved and the problems that exist will be identified and discussed. As part of the research, a survey regarding these issues will be given to students who have tried online education and the results will be evaluated.

Historical Definition and Background

The concept of distance education is not new; universities have been offering correspondence courses since the nineteenth century (McIsaac & Gunawardena , 1996). In fact, the foundation of a correspondence course at the Illinois State University in 1874 has been credited as the start of distance education at the university level in the United States (Rumble & Harry, 1982). Distance education is primarily made up of four types of media: print, voice, video, and computer (Charles, 1991). Because of the sharp increase in the use of the computer, the use of distance education in higher education has increased dramatically. According to a U.S. Department of Education study ("ED Study..., " 1997), about ninety percent of all higher education institutions with enrollments of ten thousand or more will be offering some form of distance education by the fall of 1998; seventy-six percent were offering distance education programs in the fall of 1995.

Two driving forces have led to the drastic increase in the area of distance education. First, there has been a technological revolution in the last decade. Today's personal computers have as much computing power as large mainframes had just ten years ago (Baird & Monson, 1992). The following testimony given before the U.S. Senate Committee on Labor and Human Resources on April 15, 1997 illustrates this technological evolution:

One of the hardest things for most people to understand is the effect of information technology's exponential rate of improvement. For the last four decades, the speed and storage capacity of computers have doubled every 18-24 months; the cost, size, and power consumption have become smaller at about the same rate. The bandwidth of computer networks has increased a thousand-fold in just the last decade, and the traffic on the network continues to grow at 300-500 percent annually. For the foreseeable future, all of these trends will continue; the basic technology to support their continued advance exists now. (Wulf, 1997).

These computer and communication technological advances have provided alternatives to the traditional classroom setting. Technology is having, and will continue to have a profound impact on institutions in America and around the globe. According to Phipps & Merisotis (1999), distance education, which was once "a poor and often unwelcome stepchild within the academic community, is becoming increasingly more visible as a part of the higher education family."

Secondly, the population is getting older and adults are increasingly pursuing advanced degrees. (Beaudoin, 1997). It is estimated that fewer than one-fourth of the students on college campuses today are between the ages of eighteen and twenty-two and attending full-time as a traditional undergraduate student (Twigg, 1994). Time constraints, due to job and family commitments, and distance to the facility often act as primary barriers to advanced education. Distance education overcomes many of these barriers and allows the learners access to the educational system.

Even though the use of distance education is more widely accepted, there has been and continues to be a large debate as to the true definition of "distance education". Desmond Keegan's revised definition is most often quoted. He proposes that the following elements are needed to have distance education:

- The quasi-permanent separation of teacher and learner throughout the length of the learning process;
- The influence of an educational organization both in the planning and preparation of learning materials and in the provision of student support services;

- The use of technical media: print, audio, video, or computer to unite teacher and learner and to carry out the content of the course;

- The provision of two-way communication so that the student may benefit from or even initiate dialogue; and,

- The quasi-permanent absence of the learning group throughout the length of the learning process so that people are usually taught as individuals and not in groups, with the possibility of occasional meeting for both didactic and socialization purposes (Keegan, 1988, p. 10).

Garrison and Shale (1987), however, argue that the definition is too restrictive. Recent developments in technology have made the boundaries between distance and traditional education less distinguishable. Garrison and Shale are concerned that innovative developments that provide successful delivery in education may be excluded in order to maintain that distance education as a unique phenomenon. The educators found particular fault with the last element of the definition. Teleconferencing using audio, video, or computers is currently being utilized by many institutions as a valid means of distance education. Teleconferencing by definition is a group method of learning that provides for real-time interaction among all participants in a manner of a traditional classroom. According to Keegan, this method of delivery cannot be considered a from of distance delivery because people are not taught individually.

Verduin and Clark (1991) also debated Keegan's definition arguing that it was too restrictive. They developed their own definition which consists of the following criteria:
- The separation of teacher and learner during at least a majority of the instructional process;
- The influence of an educational organization, including the provision of student evaluation;
- The use of educational media to unite teacher and learner and carry course content; and,
- The provision of two-way communication between teacher, tutor, or educational agency and the learner.

The first element expands on Keegan's definition to include a broader range of activities. The second element contains the important aspect of student evaluation, which was missing from Keegan's definition. The fourth element recognizes that there may be contact with different representatives of the educational organization for different purposes. And finally, the fifth element has been completely omitted because distance education applied equally to both groups and individuals. The definition of Vnduin and Clark will be used for purposes of this paper.

The California Distance Learning Project in 1997 reviewed some of the research on successful students in distance education programs and found that the students were typically voluntarily seeking further education, are motivated and are more disciplined, tend to be older than the average student, and tend to possess a more serious attitude toward their courses (Palloff & Pratt, 1999). Nipper (1989) describes these successful learners as "noisy learners", that is one who is active and creative in the learning process. According to Star Roxanne Hiltz (1993) participation in on-line courses should ideally be voluntary. Students with negative attitudes tend to have a self-fulfilling prophecy of an unsuccessful educational experience.

Historically, the educators' expectations always seems to have exceeded the development of programs that could use the systems to their full potential. For example, Thomas Edison predicted that "books will soon be obsolete in the schools. Scholars will soon be instructed through the eye. It is possible to teach every branch of human knowledge with the motion picture. Our school system will be completely changed in ten years." (Voegal, 1986, p. 73). Obviously, this prediction was not fulfilled. However, with the emergence of the computer, the field of distance education will definitely play a key role on most college campuses.

According to Nipper (1989) and Kauffman (1989), three generations of distance education exists. The first generation was characterized by the use of a single technology and the lack of direct interaction between the learner and the teacher. Correspondence education is a typical form of first generation distance education.

The second generation distance education is characterized by an integrated multiple-media approach. Learning materials are specifically designed for study at a distance. Direct interaction between the teacher and the learner is still lacking. Autonomous distance teaching universities are examples of second generation distance education.

Third generation distance education is based on two-way communications media that allows for direct interaction between the teacher, who originates the instruction and the remote learner. Interaction also occurs between the learners individually or as a group. Third generation distance education technologies results in a much more equal distribution of communication between the learners and the teacher.

There is clearly a progressive increase in learner control, opportunities for dialogue, and emphasis on thinking skills in the third generation distance education (Kauffman, 1989). These elements begin to reveal the development of a new paradigm in education. In the third generation of distance education, the instructor continues to define course content. However, students have more opportunities to explore the content collaboratively or to pursue their own, related interest. (Palloff & Pratt, 1999). Palloff & Pratt explain, however, that the "key to the learning process are the interactions among students themselves, the interactions between faculty and students, and the collaboration in learning that results from these interactions."

Theoretical Background

EDUCATION

The definition of "learning" is defined in Webster's Dictionary as "knowledge or skill acquired by instruction or study". The learning process can be achieved in many ways. The primary task of education is to develop the potential of the learner. In the educational process, the teacher must provide the setting that is conducive to learning. (Dewey, 1916) Dewey rejected the view that the teacher should merely stand off and look on. Instead, the relationship between the teacher and learners should be interactive and a learning experience for all involved. The role of the educator is extremely important, for educational experiences are likely to happen where there are teacher-guided interactions between persons and the environment. An educator's task is not just to capitalize on the interests that already exist in the learner, but to arouse interest in those things that are educationally desirable. Thus, telecommunications requires changes in the teaching patterns and practices of the faculty as they must learn to relinquish a degree of control over the teaching-learning process (Dillon, 1989) It is common to "carry over modes of design associated with an 'old' technology to a newer technology, even though the new technology may have inherent design advantages (or disadvantages) over the old technology." (Bates, 1995 at p.9) Thus, it is important for teachers to reconsider the design of teaching and learning activities when technology is used.

According to Hills (1979), higher education is a form of communication between society and the individual learner, where the standards and accumulated knowledge of society is communicated to the next generations. Hills based his work on integrating psychology issues and social issues with Shannon and Weaver's (1949) theory of communication. The four elements of Hill's communication model include motivation, activity, understanding, and feedback.

COMPUTER-MEDIATED COMMUNICATION

The role of communication plays a significant role in the success of distance education. Communication is a collective activity. (Clark & Brennan, 1991) Efficient communication is only possible when the communicators have a common ground. Common ground refers to the mutual knowledge, beliefs, and assumptions of the participants in a conversation. During the conversation, common ground is updated by each participant to ascertain whether or not the others have understood their communication. The process of updating during the communication is called grounding. (Clark & Schaefer, 1987, 1989) McCarthy & Monk (1994) integrated the theory of common grounding (Clark & Brennan, 1991) with the Shannon and Weaver's (1949) theory of communication with research on cognition. Shannon and Weaver's theory of communication was used by both Hill and McCarthy & Monk, which suggests a link between these two models (Mandviwalla & Hovav, 1998).

The framework designed by McCarthy & Monk was based on a multidisciplinary approach to computer-mediated communication in which they developed an information processing model. They identify three resources that facilitate grounding. First, they suggest a multi-channel communication system. Face to face communication is deeded to be the "richest channel configuration" available. Ellis and Beattie (1986) found that there are actually five channels in face-to-face communications: verbal, prosodic, paralinguistic, kinetics, and standing features. Because many students are visual learners, images are almost always the most effective communication medium. John Walsh (1992) estimated that approximately seven percent of the messages is received by word meaning; thirty-eight percent is attributed to how it is said; and fifty-five percent of the communication message is in the form of visual cues. Hills (1979) also noted that non-verbal cues were a vital component of the teacher's communication.

Social psychological effects have been studied by comparing the computer-mediated communication with face-to-face communication. The computer-mediated communication relies primarily on text. Social context cues regarding gender, age, or status are eliminated. This absence of cues appears to hamper communication efficiency and create a lack of awareness of social content. (Bordia, 1997) As a result, there is a perceived higher incidence of rude, offensive and uninhibited behavior. (Kiesler, Siegel, & McGuire, 1984).

Using computer-mediated communication restricts the number of channels available, particularly the visual cues. For communication to be effective, a multi-channel environment must be a goal in order to facilitate grounding.
Second, structure is an important factor in coordinating the communication from one interaction to the next interaction. Structural constraints, such as turn taking, assist in repairing any misunderstandings during the conversation. Third, the participants in a conversation must

cooperate and keep the communication relevant. Thus contractual constraints are necessary. The availability and use of multiple channels and the structural and contractual constraints utilized in the communication will impact the learning process. (Mandviwalla & Hovav, 1998) INTERACTION

Moore's (1989) interaction model relies upon three types of interaction essential in distance education. First, is the learner-instructor interaction. This interaction involves the motivation, feedback, and dialogue between the teacher and learner. Second is the learner-content interaction in which the learners obtain intellectual information from the session. Third, is the learner-learner interaction, which is the exchange of information, ideas and dialog that occur between students about the course. This can be done in a structured or non-structured manner. This concept, like grounding, is fundamental to the effectiveness of learning, whether in distance education or by traditional means. Hillman, Willis, and Gunawardena (1994) added a fourth component to Moore's model. The additional element is the learner-media interaction. This element was added because the interaction between the learner and technology is a critical component. Learners that are not comfortable with the use of the technology which is used spend a large amount of time learning to interact with the technology and have less time to learn the lesson. They propose a new paradigm which includes understanding the use of the interface in all transactions.

Model

This case study will rely primarily upon Moore's (1989) interaction model as modified by Hillman, Willis, and Gunawardena (1994). Our model, however, has added a fifth element, the teacher-interface interaction. This element was added because the interaction between the teacher and technology is also vital in computer-mediated courses. These courses are demanding as the teacher becomes the commentator, the subject matter expert, and the course designer rolled into one (Hudspeth & Brey, 1986). The teacher must become comfortable with the medium being used and use it efficiently. The model will also draw upon Hills (1989) educational model and McCarthy & Monk's (1994) communication model. The factors of the learner-instructor interaction are similar to Hills (1989) model. The computer-mediated communication model of McCarthy & Monk (1994), which is based upon grounding, is necessary for the learner-instructor and the learner-learner interactions.

Figure 2 presents the implementation model of the case study. Each of the five interactions are an important aspect of this model

The case study

The goal in this study was to determine the impact of each of the interactions using technology on the success of the educational outcome, as determined by the students. A questionnaire was given to both graduate and undergraduate students in four classes at two universities. The courses were in either the computer science or business information curriculums. Each of the classes were taught by a different professor. All of the courses combined face-to-face and on-line classroom discussions. Both asynchronous and synchronous communications were used in all of the classes. The asynchronous communications consisted of e-mail and bulletin boards.

Students were encouraged in each of these courses to use traditional communications as well as computer-medicated communications to interact with the teacher and the other students. All courses involved only text based discussions. No special training relating to the technology was provided to the students. Assignments and syllabi were posted on the class website. Feedback from the teachers were also routinely provided on-line.

The subjects of this case study do not represent a random cross-section of the population. All of the participants had extensive knowledge in the area of technology. Also, if the students participated in more than one on-line class recently, it is unsure if there was any bias in the way they completed the questionnaire.

Results and discussion

The questionnaire found that the majority of students were part-time students. The primary reasons for taking the class were to traveling time unnecessary and to alleviate time constraints due to their family or career. The remaining results of the questionnaire illustrate the advantages and disadvantages of using technology in distance education using the interaction model.

Learner-Instructor Interaction/Learner-Learner Interaction

The learner-instructor interaction in Moore's model provides the motivation, feedback, and dialog between the teacher and student. The learner-learner interaction is the exchange of information, ideas and dialog among the students. Because both of these interactions are based primarily on the communication function, the two interactions will be discussed together.

In the questionnaire, the majority of students agreed that the scheduled synchronous sessions provided an effective forum of discussion with their teacher and the other students. Furthermore, ninety-two percent of the students felt comfortable participating in class discussions using the technology. In fact, sixty-seven percent of the students said they participated more in the synchronous sessions than they would have in a classroom discussion. Sixty-seven percent of the students, however, found that the transmission delay or response time of the technology hindered the effectiveness of the classroom discussion. However, the majority of the students agreed that the synchronous sessions impacted positively on the overall interaction with the instructor and the students.

Over eighty-three percent of the students stated that they could communicate with the professor and fellow students easily outside the scheduled online meetings using asynchronous technology. And, over sixty-four percent felt that asynchronous communication played an important role in the success of the class.

However, eighty-two percent of the students felt that lack of face-to-face non-verbal cues hindered the effectiveness of the class discussions. And, eighty-two percent of the students agreed that face-to-face classroom sessions were necessary to make the class a success. As a result, only forty-one percent agreed that they had learned as much from the on-line class as they would have from face-to-face classroom sessions.

From the results, students still indicate that the visual non-verbal cues and lack of face-to-face discussions hindered the effectiveness of the classroom discussions. Students indicated that the face-to-face interaction assisted in the learning process. In fact, the vast majority of the students agreed that face-to-face classroom sessions were necessary. Students in this study actually participated more in the on-line sessions than in face-to-face discussions. It appears that the students are more willing to participate because there is a greater equality in the group. The positive results, however, may be skewed because the participants all came from the same educational background and were comfortable with the technology.

Learner-Content Interaction

The learner-content interaction is the method by which students obtain intellectual information from the material. In the questionnaire, the majority of the students agreed that they had a good understanding of the material presented. Students commented, however, that a combination of face-to-face instruction and on-line discussions were needed to obtain understanding of the material. Thus, it appears from the analysis of the learner-learner and learner-instructor analysis and the outcome of the course that the learner-content interaction was unacceptable. Only forth-one percent of the students indicated that they learned as much from the on-line course as they would have from face to face classroom discussions.

Learner-Interface Interaction

The learner-interface interaction is the interaction between the learner and the technology which delivers instruction. Approximately half of the students agreed that more training in the technology should have been given prior to the course. Because the students were all enrolled in computer-related courses, this percentage would likely be much higher in the non-technical course. Also, over seventy-five percent of the students agreed that the ability to type played an important role in the success of the on-line course. Thus, the student's knowledge of the technology plays an important role in the learning process.

Instructor-Interface Interaction

The students unanimously agreed that the professor's knowledge and use of the technology was important in the overall success of the class. In the comment section of the questionnaire, students frequently commented that the instructor must feel comfortable with the technology and use it with ease in order to have effective classroom discussions. The teacher must develop skills in controlling and responding to student questions without any creating a feeling that the question was inappropriate. The teacher must also make the students feel part of the class by using technology to include all of the students. One student remarked that the technology is available to make the course exciting and challenging if the teacher becomes comfortable with the technology and uses it effectively. The teachers in these courses were all competent with the use of technology. However, this interaction should be carefully reviewed when using on-line courses in other disciplines.

Conclusion

Technology in distance education is becoming increasingly more accepted in the system of higher education. As new courses are offered using computer-medicated communication, care should be taken to make certain that the interactions of the learner, instructor, content, and technology are successful. Research on the use of computer-mediated communication in distance education has just recently begun. The use of the interaction model in the case study illustrates the importance of the learner-learner, learner-instructor, learner-interface, instructor-interface, and learner-content interactions. Based upon the result of the case study, the paper proposes generic requirements for designers to consider when designing software to be utilized in distance education. The use of technology in distance education is valuable to the pedagogical experience. Designers and researchers, however, need to more fully consider the communication and interaction models when designing future software in distance education.
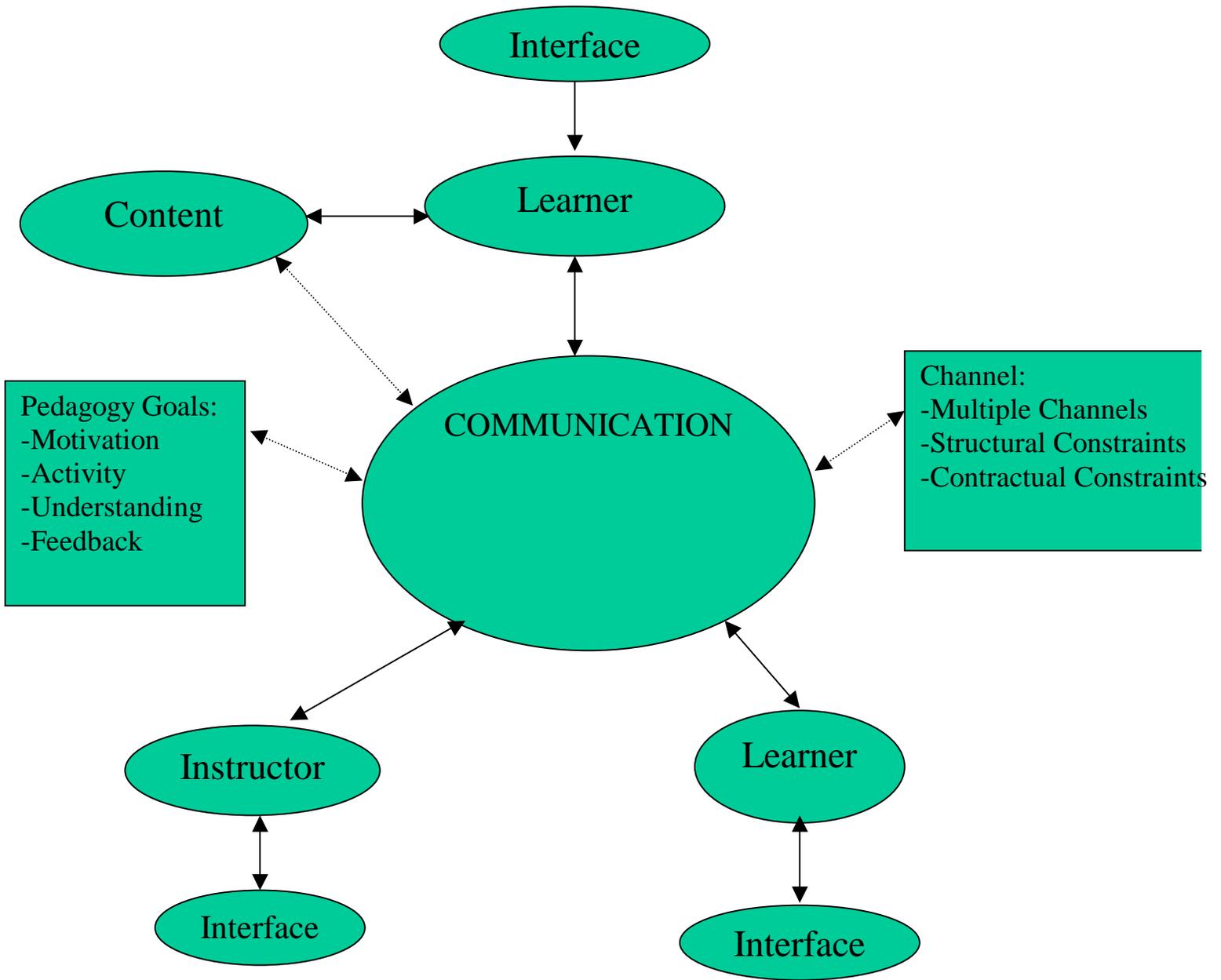
Interface

Learner

Content

COMMUNICATION

Pedagogy Goals:
-Motivation
-Activity
-Understanding
-Feedback

Channel:
-Multiple Channels
-Structural Constraints
-Contractual Constraints

Instructor

Learner

Interface

Interface

Figure 1:   Interaction Model

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