Technology and Instructor-Interface Interaction in Distance Education

Azim Danesh
Shippensburg University
1871 Old Main Drive
Shippensburg, PA 17257

April Bailey
Shippensburg University
130 Brightwater Drive, #3
Clearwater Beach, FL 33767

Thomas Whisenand
Shippensburg University
1871 Old Main Drive
Shippensburg, PA 17257

Abstract

Many universities and colleges have been expanding distance education offerings. This paper examines the role of technology in interaction and communication as relates to distance education. Interaction models were extended to include the instructor-interface interaction. The impact of each interaction on the success of the educational outcome, as determined by the students completing a questionnaire, was compiled for classes. The results showed that learner-instructor and learner-learner interactions, when used synchronously or asynchronously, were perceived as effective discussion modes and played an important role in the success of the class. The students felt the lack of face-to-face non-verbal cues hindered the effectiveness of class discussions. They participated more in online sessions than in face-to-face discussions and a combination of both was preferable to better understand the material. The article also discusses the knowledge of technology and its role in the learning process.

Keywords: distance education, online learning, e-learning

Introduction

With the exponential growth of the Internet, the proliferation of course and content management systems, and popularity of online/distance education, more institutions in higher education are expanding their online course offerings. Technological advances in computer hardware, software, telecommunication systems, and mobile computing have supported alternatives to the traditional face-to-face classroom setting. The supporting technology infrastructure and interaction software are the basic building blocks of the online learning paradigm. While online learning affords learners and educators many new opportunities and overcomes many of the barriers of traditional education, it also introduces some challenges and limitations.

After a review of the literature of distance education and communication, and the use of technology in online education, this paper focuses on issues regarding technology and media as it relates to collaboration, interaction, and communication involving various entities. As part of this research, a survey was designed and given to students who participated in online/distance education courses. The survey's results are discussed and evaluated.

Distance Education

Distance education is not a new concept. It has been used in contemporary education to reduce geographical boundaries (Farag, 2012). Educational institutions 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). Many well respected colleges have implemented online courses and programs. Several, such as Harvard University and Massachusetts Institute of Technology offer free public courses.

Distance education is primarily made up of four types of media: print, voice, video, and computer (Charles, 1991). With advances in technology, telecommunications, and access to computer, advances in distance education in higher education has increased dramatically (Farag, 2012; Livingstone 2012). According to a U.S. Department of Education National Center for Education Statistics (NCES) study completed in the 2006–07 academic year, "66 percent of the 4,160 2-year and 4-year Title IV degree-granting postsecondary institutions in the nation offered college-level distance education courses. The overall percentage includes 97 percent of public 2-year institutions, 18 percent of private for-profit 2-year institutions, 89 percent of public 4-year institutions, 53 percent of private not-for-profit institutions, and 70 percent of private for-profit 4-year institutions." Additionally, the survey found that "Sixty-five percent of the institutions reported college-level credit-granting distance education courses, and 23 percent reported noncredit distance education courses." The U.S. Department of Education, NCES estimates that during the 2006-07 academic year "12.2 million enrollments (or registrations) in college-level credit-granting distance education courses and of these enrollments, "77 percent were reported in online courses, 12 percent were reported in hybrid/blended online courses, and 10 percent were reported in other types of distance education courses." (U.S. Department of Education NCES, 2008). At a national level, from this survey it was approximated that "11,200 college-level programs that were designed to be completed totally through distance education; 66 percent of these programs were reported as degree programs and the remaining 34 percent were reported as certificate programs" (U.S. Department of Education NCES, 2008).

The increase interest in distance education can be attributed to two major factors. The advances in computing and telecommunication technologies and the change in the demographic population of college students. Technology is having, and will continue to have a profound impact on institutions in America and around the globe. These technological advances in computers and communications have provided alternatives to the traditional classroom setting. 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." For example, Virginia Polytechnic Institute and State University has since 1999 experienced a growth in eLearning course offerings to a current 6,000 and total enrollments to 600,000. They also report that during their 2009-2010 academic year, 96% of their academic departments' were engaged in developing and delivering e-Learning courses (VirginaTech, 2011).

The second has been the effect of our aging population on the make-up of the college student body. Technology and the information age are changing the nature of adult learning and as the population ages, adult students are increasingly pursuing advanced degrees (Merriam, Caffarella, & Baumgartner, 2006). Distance education/eLearning courses are especially attractive to this subset of students. Online delivery has made education a practical and flexible way to earn a degree or to gain professional development. The trend for online learning has been well received by higher education administration and students and is not likely to be going away anytime soon (Farag, 2012). In a study of 23,592 e-learners, Godwin, Thorpe, and Richardson (2008) found a mean age of 38.8 years. It is estimated that fewer 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.

While the use of distance education is more widely accepted, there has been and continues to be a debate as to the true definition of "distance education." Keegan's (1988) revised definition is among the most often quoted has a variety of elements the most important being, a quasi-permanent separation of teacher and learner throughout the length of the learning process through the use of technical media: print, audio, video, or computer to unite teacher and learner and to carry out the content of the course and conduct communication. He also emphasizes the absence of learning group in distance education since people are taught as individuals and not in groups. Other authors argue for a less restrictive definition such as Garrison and Shale (1987) and Verduin and Clark (1991) who debated Keegan's definition arguing that it was too restrictive.

Verduin and Clark (1991) 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;
- The provision of two-way communication between teacher, tutor, or educational agency and the learner.

They expand on Keegan's definition to include a broader range of activities and emphasis the important aspect of student evaluation. In addition, the absence of learning group has been omitted because distance education applied equally to both groups and individuals.

Distance education according to the U.S. Department of Education, NCES is defined as a "formal education process in which the students and instructor are not in the same place." Thus, instruction may be synchronous or asynchronous, and it may involve communication through the use of video, audio, or computer technologies, or by correspondence (including written correspondence and the use of technology such as CD-ROM). Distance education includes courses and programs that were formally designated as online, hybrid/blended online (combination of online and in-class instruction with reduced in-class seat time for students), and other distance education courses and programs" (U.S. Department of Education NCES, 2008).

The learning process can be achieved in many ways. Learning is defined in Webster's Dictionary as "knowledge or skill acquired by instruction or study". 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 the learning (Dewey, 1916). Dewey rejected the idea that the teacher should pass on the knowledge and merely standoff and look on. Instead, the learner should be actively engaged, and the relationship between the teacher and learners should be interactive, providing 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 the students 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). Thus, it is important for teachers to reconsider the design of teaching and learning activities when technology is used. Furthermore, the subject matter may be more challenging when teaching is delivered online. This can be understandable particularly in a technology design course where students are learning to navigate specialized software packages without prior experience (Senn, 2008). Scholars suggest that there is no difference found in studies examining the final student scores between hybrid and face-to face sections. Therefore, one can conclude that students who enroll in hybrid sections are understanding and retaining the material as well as face-to-face students (Branoff & Wiebe, 2009).

Technology and Communication

Garrison, Anderson, and Archer (2004) suggest that "the adoption of computer-mediated communication (CMC) in higher education has far outpaced our understanding of how this medium should best be used" and we need to study the "interactions, perceptions, and outputs of participants engaged in the use of CMC for educational purposes."(p.1) Communication plays a significant role in the success of distance education and is a collective activity (Clark & Brennan, 1991). Effective communication is possible when the people involved have a common ground which is the mutual knowledge, beliefs, and assumptions of the participants in a conversation. Common ground is updated by each participant to ensue whether or not the others have understood their message. The process of updating during the communication is called grounding (Clark & Schaefer, 1989). McCarthy & Monk (1994) integrated the theory of common grounding (Clark & Brennan, 1991) and Shannon and Weaver's (1949) theory of communication with research on cognition.

McCarthy & Monk developed their information processing model based on a multidisciplinary approach to computer-mediated communication. In order to facilitate grounding, 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 five channels in face-to-face communications: verbal, prosodic, paralinguistic, kinetics, and standing features. Since many students are visual learners, images are one of the most effective form of communication media.

Walsh (1992) estimated that approximately seven percent of the message 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 concurring with Hills (1979) who also noted that non-verbal cues were a vital component of the teacher's communication.

Comparing the computer-mediated communication with face-to-face communication have also been studied for its social psychological effects. When 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 while the use of multiple media can improve the communication and have a positive influence in learning (Balaji & Digant 2010). For communication to be effective, a multi-channel environment should be a goal in order to facilitate grounding. In addition, structural constraints comprise another grounding facilitator. They work as important factors in coordinating the communication from one interaction to the next. Structural constraints, such as turn taking, assist in repairing any misunderstandings during the conversation. Furthermore, the participants in a conversation must cooperate and keep the communication relevant. Therefore 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).

Extending the Interaction Model

Moore's (1989) interaction model relies upon three types of interaction essential in distance education: (1) learner-content; (2) learner-instructor; and (3) learner-learner. The last two are forms of interpersonal interaction and have raised the potential of unique and subtle responses to individuals and groups of learners leading researchers to stress the importance of interpersonal interaction (Bannan-Ritland, 2002; Berge, 2002; Northrup, 2002). The learner-instructor interaction involves the feedback and dialogue between the teacher and learner. Learner-content interaction is where the learners obtain intellectual information from the session. The learner-learner interaction is the exchange of information, ideas, and dialog that occur among students about the course. This may 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. The learner-media interaction was a forth component that was added to Moor's model by Hillman, Willis, and Gunawardena (1994). This component was proposed since the interaction between the learner and technology is an important element in the learning process. Learners usually devote a disproportional amount of time learning to interact with the technology if they are not comfortable with the new technology used in the course and have less time to learn the content. This study modified the above model by adding an additional dimension to it, the instructor-interface interaction. This element was added because the interaction between the instructor and technology is also an important factor in the success of 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. For the learner-instructor and learner-learner factors, the model also draws upon Hills (1979) educational model and McCarthy & Monk's (1994) computer-mediated communication model which is based upon grounding.

The Study

To determine the impact of various interaction methods on the success of the educational outcome, as observed by the students, a questionnaire was developed and administrated to graduate and undergraduate students in different classes at a business college. The courses were from both Master of Business Administration and Management Information Systems disciplines. Each of the classes was taught by a different professor. All of the courses used a mixed-mode format, combing face-to-face and online classroom discussions. Both asynchronous and synchronous communications were used in all of the classes. Email, blog, and discussion boards were used for asynchronous communications. Bernard et al (2004) found that in asynchronous distance education, media that support interactivity (i.e., CMC) appear to facilitate better attitudes and benefits achievement outcomes.

Syllabi, discussion topics, and assignments were posted on the class websites. Students were encouraged in each of the courses to use traditional communication as well as computer-mediated communication to interact with the teacher and the other students. All courses involved face-to-face, online, and text based discussions.

Feedback from the teachers was also routinely provided online. If needed, the subjects were provided with 24/7 on-line support in the use of technology by the provider of the content management software used in the courses. At the end of course, instructors administered a survey questionnaire to capture the students' perceptions. This questionnaire was comprised of Likert scale, open ended, and agree/disagree questions.

Results and Discussion

Ninety one students participated in survey. The results of the questionnaire showed that the 61% of subjects were part-time students. The primary reasons for taking the mixed-mode classes were to reduce or eliminate traveling time, and to alleviate time constraints due to their family or career demands. Majority of students believed that the ability to take part of the class on-line was an important issue in taking the course (Figure 1). The following results are discussed by interaction type and illustrate the advantages and disadvantages of technology use in distance education using the interaction model.

Learner –Instructor and Learner-Learner Interactions

Since both learner-instructor and learner-learner interactions are revolves mainly on the communication function, the two interactions will be discussed together. The learner-instructor interaction is the exchange of information, ideas, and dialog among the instructor and students. Moore's model (1989) provides the ideas, feedback, and motivation, and dialog between the students and the instructor. A study by Marks, Sibley, and Arbaugh (2005) indicated that instructor-student interaction is most important. Collins (2004), likewise, found that web-based instruction was enhanced when augmented with instructor led sessions. The learner-learner interaction is the exchange of information, ideas, and dialog among the students. Bonk et al (2000) found that interaction among students can have many benefits, including (a) improved quality of student work; (b) improved course completion rate; and (c) development of a community of learners.

Based on the questionnaire's results, 62% of students agreed that the scheduled synchronous sessions impacted positively on the overall interaction with the instructor, and 56% agreed that the synchronous sessions impacted positively on their interaction with classmates. While 71% believed that they could better communicate with the professor and fellow students easily outside the scheduled online meetings using asynchronous technology.

Various studies suggest that utilizing computer mediated communication, in particular for class participation and collaborative learning, can make a positive difference to the educational experience of some students (Scarborough and Graham 2001; Livingstone 2012; Abrami, et al. 2011). In the study, 82% of the students felt comfortable participating in class discussions using the technology. In fact, 64% of the students said they participated more in the synchronous sessions than they would have in a classroom discussion, while 62% of the students felt that the technology hindered the effectiveness of the classroom discussion due to transmission delays and or slow response times. Students in this study actually participated more in the online sessions than in face-to-face discussions. It appears that the students were more willing to participate because there is a perception of greater equality in the group. Since majority of the students came from the same educational background and were at ease with using the technology, our results may have been affected.

Instructor-Interface and learner-Interface Interaction

For interaction between the teacher and technology, 64% of the students agreed that the professor's knowledge and use of the technology during the synchronous sessions was critical to the overall success of the class. In the comment section of the questionnaire, students stated that the instructors who felt comfortable with the technology and used it with ease, had a more effective classroom discussions. The teacher must develop skills in controlling, engaging, and responding to student questions without creating a feeling that the question was inappropriate. The instructor must also make the students feel part of the class by using technology to include all of the students. Students also mentioned 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 professors in these courses were overall efficient in the use of technology. However, this interaction should be carefully reviewed when using online courses in other disciplines. We urge teachers to rethink their pedagogy to exploit the opportunities offered by new and varied media and technologies as suggested by Laurillard (2002).

Learner-interface plays an important role in the learning process. The student's knowledge of the technology-interface interaction is the interaction between the learner and the technology which delivers instruction.

Since majority of the students were enrolled in computer-related courses and have been using technology during their academic careers, only 19% of the students agreed that more training in the technology should have been given prior to the course. This percentage would likely be higher in the non-technical course.

Learner-Content Interaction

The learner-content interaction is the method by which students obtain intellectual information from the material. The result indicated that the majority of the students agreed that they had a good understanding of the material presented. Students commented, that the asynchronous communication played an important role in the success of the class, however, that a combination of face-to-face instruction and online discussions were needed to obtain understanding of the material. Thus, it appears from the analyses of the learner-learner and learner-instructor interactions and the outcome of the course that the learner-content interaction by itself was unsatisfactory. The students felt that lack of face-to-face (visual non-verbal cues and face-to-face discussions) non-verbal cues hindered the effectiveness of the class presentations and discussions and agreed that face-to-face classroom sessions were necessary to make the class a success (Figures 2-4). Only 54% of the students indicated that they learned as much from the online session as they would have from face-to-face classroom discussions. Students agreed that face-to-face classroom sessions were needed and indicated that the face-to-face interaction assisted in the learning process.

Conclusions

Advances in technology has produced a rapid pace of change and a competitive environment in today's information based societies (Danesh and Kock 2005, Kock et al. 2008). In addition, the use of technology has become a vital aspect of the pedagogical experience and in our ability to learn and comprehend. Although distance learning is affecting the future of higher education, its efficacy needs to be more studied and analyzed. While students indicated they enjoyed the flexibility that online learning brings, personal preference continues to favor better interaction as future generations will be more open to remote and individualized education. The use of the interaction model in this case study illustrates the importance of the learner-learner, learner-instructor, learner-interface, instructor-interface, and learner-content interactions to be considered for future research and development of distance education course content and software tool to fully engage and communicate with students.

Limitation and Future Research

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

A natural follow up to this study is to measure students' perception from a wider range of background. Also, studies to compare various software design guidelines and modes of communication in order to help designers and researchers to consider communication and interaction models when designing software for distance education.

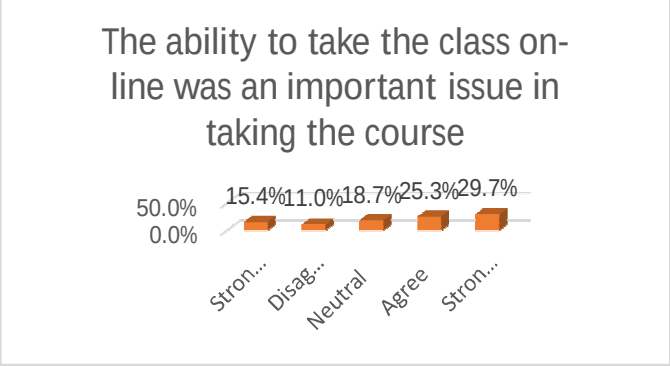

Figure 1

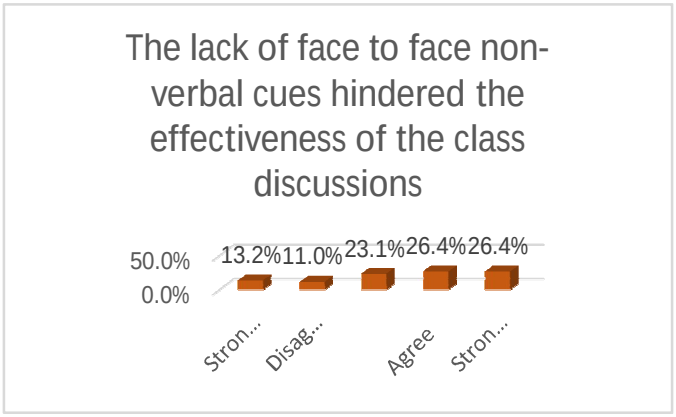

Figure 2

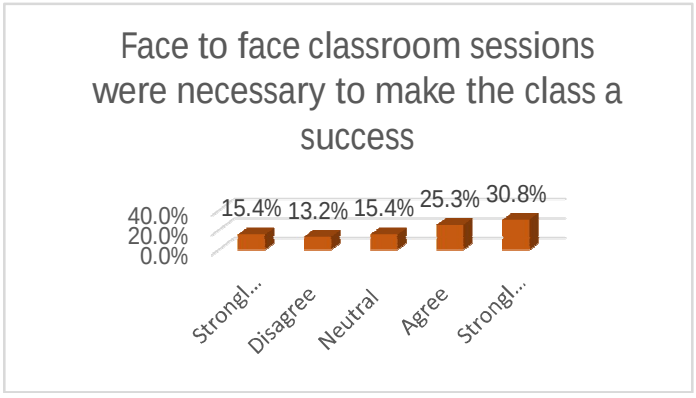

Figure 3

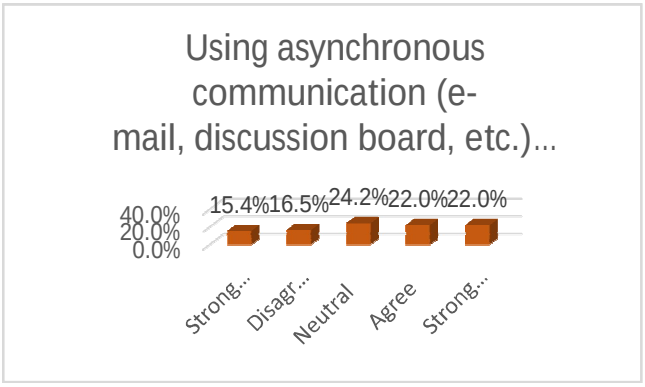

Figure 4

References

Abrami, P. C., Bernard, R. M., Bures, E. M., Borokhovski, E., & Tamim, R. M. (2011). Interaction in distance education and online learning: using evidence and theory to improve practice. Journal of Computing in Higher Education, 23(2-3), 82-103.

Balaji, M.S., Chakrabarti, D. (2010). Student interactions in online discussion forum: Empirical research from 'media richness theory' Perspective, Journal of Interactive Online Learning, 9(1).

Bannan-Ritland, B. (2002). Computer-mediated communication, elearning and interactivity: A review of the research. The Quarterly Review of Distance Education, 3(2), 161-179.

Berge, Z.L. (2002). Active, interactive, and reflective elearning. The Quarterly Review of Distance Education, 3(2), 181-190.

Bernard, R.M,, Abrami, P.C., Lou, Y., Borokhovski, E., Wade, A., Wozney, L., Wallet, P.A., Fiset, M., & Huang, H. (2004). How does distance education compare with classroom instruction? A meta-analysis of the empirical literature. Review of Educational Research, 74(3).

Bonk, C., Kirkley, J., Hara, N., & Dennen, V. (2000, April). Advances in pedagogy: Finding the instructor in post-secondary online learning. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA,

Bordia, P. (1997). Face to face versus computer-mediated communication: A synthesis of the experimental literature. The Journal of Business Communication, 34(1), 99-120.

Branoff, T., & Wiebe, E. (2009). Face-to-face, hybrid, or online?: Issues faculty face redesigning an introductory engineering graphics courses. Engineering Design Graphics Journal, 73(1), 25-31.

Charles, I. (1991). Adaptions of distance education. ITCA Teleconference Yearbook.

Clark, H.H. & Brennan, S.E., Grounding in communication. In Resnick L., Levine J., & Teasley, S.D. (Eds.). (1991). Perspectives on Socially Shared Cognition, American Psychological Association, Washington.

Clark, H.H. & Schaefer, E.F. (1989). Contributing to discourse. Cognitive Science, 13, 259-294.

Collins, G.R.. (2004). Augmenting web-based instruction with satellite video: A case study. Journal of Teaching in Travel and Tourism, 4(1), 57-74.

Danesh, A., & Kock, N. (2005). Communication-Based Versus Workflow-Based Redesign: Some Observations From An Experimental Study. Review of Business Information Systems (RBIS), 9(4), 119-130.

Dewey, J. (1916). Democracy and Education, New York: MacMillan.

Dillon, C. (1989). Faculty rewards and instructional telecommunications: A view from the telecourse faculty. The American Journal of Distance Education, 3(2), 35-43.

ED Study Documents Growth of Distance Learning. (1997). NACUBO News, Retreived from http:/ /www .nacubo.org/website.hll 00697.html.

Ellis, A. & Beattis, G. (1986). The Psychology of Language and Communication, London: Weidenfeld and Nicholson.

Farag, W. (2012). Comparing achievement of intended learning outcomes in online programming classes with blended offerings. Special Interest Group for Information Technology Education, 25-30.

Garrison, D.R., Anderson, T. & Archer, W. (2004). Critical thinking, cognitive presence, and computer conferencing in distance education. The American Journal of Distance Education, 13(1), 57–75.

Garrison, D. & Shale, D. (1987). Mapping the boundaries of distance education: Problems in defining the field. The American Journal of Distance Education, 1(1), 7-13

Godwin, S. J., Thorpe, M. S., & Richardson, J. T. E. (2008). The impact of computer-mediated interaction on distance learning. British Journal of Educational Technology, 39 (1), 52–70.

Hills, P. (1979). Teaching and Learning as a Communication Process, New York: Wiley.

Hillman, D.C., Willis, D., & Gunawardena, C.N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. The American Journal of Distance Education, 8(2), 30-42.

Hudspeth, D. R., & Brey, R. G. (1986). Instructional telecommunications: Principles and applications. New York: Praeger Special Studies.

Keegan, D. (1988). Problems in defining the field of distance education. The American Journal of Distance Education, 2(2), 4-11.

Kiesler, S., Siegel, J., & McGuire, T.W. (1984). Social psychological aspects of computer-mediated communication, American Psychologist, 39(10), 1123-1134.

Kock, N., Danesh, A., & Komiak, P. (2008). A discussion and test of a communication flow optimization approach for business process redesign, Knowledge and Process Management, 15(1), 72-85.

Laurillard, D. (2002). Rethinking University Teaching (2nd Ed.). Routledge-Falmer, London.

Livingstone, S. (2012). Critical reflections on the benefits of ICT in education. Oxford Review of Education, 38(1), 9-24.

Mandviwal1la, M. & Hovav, A. (1998). Adapting business process redesign concepts to learning processes. Business Process Management Journal, 4(3), 186-203.

Marks, R.B., Sibley, S.D., & Arbaugh, J.B. (2005). A structural equation model of predictors for effective online learning. Journal of Management Education, 29(4), 531-563.

McCarthy, J. & Monk, A. (1994). Channels, conversation, cooperation and relevance. Collaborative Computing, Vol. 1, 35-60.

McIsaac, M.S. & Gunawardena. (1996). Distance education. In Jonassen, D.H. (Ed.) Handbook of Research for Educational Communications and Technology: a Project of the Association for Educational Communications and Technology, New York: Simon, Schuster & MacMillan, 403-437.

Merriam, S. B., Caffarella, R. S., & Baumgartner, L. M. (2006). Learning in Adulthood: A Comprehensive Guide (3rd ed.). San Francisco: Jossey-Bass.

Moore, M.G. (1989). Three types of interaction. The American Journal of Distance Education, 3(2), 1-6.

Northrup, P.T. (2002). Online learners' preferences for interaction. The Quarterly Review of Distance Education, 3(2), 219-226.

Palloff, R.M. & Pratt, K. (1999). Building Learning Communities in Cyberspace, San Francisco: Jossey-Bass.

Phipps, R. & Merisotis, J. (1999, April). What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education. The Institute for Higher Education Policy.

Rumble, G. & Harry, K. (1982). The Distance Teaching Universities, New York: St. Martin's Press.

Scarborough, H. & Graham, M. (2001). Enhancing the learning environment for distance education students. Distance Education, 22(2), 232-244.

Senn, G. J. (2008). Comparison of face-to-face and hybrid delivery of a course that requires technology skills development. Journal of Information Technology Education, 7, 267-283.

Shannon, C.E. & Weaver, W. (1949). The Mathematical Theory of Communication, Urbana: University of Illinois Press.

Twigg, C. (1994 Sept/Oct). The need for a national learning infrastructure. Educom Review, Retrieved from http. www/educom.edu/web/pubs/review/reviewarticles/29 516.html.

U.S. Department of Education, National Center for Education Statistics. (2008). Distance Education at Degree-Granting Postsecondary Institutions: 2006-07. Retrieved from National Center for Education Statistics http://nces.ed.gov/fastfacts/display.asp?id=80

Verduin, J. & Clark, T. (1991). Distance Education -The Foundations of Effective Practice, San Francisco: Jossey-Bass.

VTOnline. (2011). eLearning at Virginia Tech 2009-2010 Academic Year Statistics. Retrieved from VirginaTech, http://www.vto.vt.edu/facts.php

Walsh, J. (1992). Personal video: A reality, ITCA Teleconferencing Yearbook.