ASSESSING STUDENTS' ATTITUDE TOWARDS COMPUTER TECHNOLOGY

Kageni. O. N[*1], Havice W. L. [2] , Isbell C. [3] , Smith R.[4]

[1] Kabarak University, Kenya
[2&3] Clemson University, Clemson, South Carolina, USA
[4] Massachusetts Maritime Academy, USA

*Corresponding author e-mail: niwanjagi@yahoo.com

ABSTRACT

Recent advances, especially in computer technology, have heralded the development and implementation of new and innovative teaching strategies. Exposing learners to computer technology may influence their behavior and hence attitude towards learning. The purpose of this study was to assess students' attitude towards computer technology in a history class. Specifically, the study assessed differences in attitude change towards both computer technology for students using web-based resources and those using traditional textbooks, and whether the level of computer literacy was a predictor of attitude towards computer technology. Thirty eight students from Bridgewater State College, 70 from Massachusetts Maritime Academy, and 54 from Clemson University formed the sample for the study selected from already existing classrooms instructed using web-based learning resources. A pre-test-post-test; non-equivalent control group design was used. The treatment group was instructed using Web-based electronic textbook, while the control group was instructed utilizing traditional textbook. A Likert-type scale was developed to measure the attitude towards computer technology and attitude towards the history class. ANOVA was used to assess differences in attitude change. Alpha was set at 0.05. Results of the study indicate that students from both groups had good attitude towards computer technology with web based group posting mean of 3.55 and traditional group 3.47 on a 5 point scale. There was a positive significant relationship between computer literacy and attitude towards computer technology significance level of 0.016. The results from this study should help educators in curriculum planning appreciate the importance of computer literacy skills for fresher's as well as continuing students.

Key words: Computer technology, student attitudes, History, Web based, computer literacy

Introduction

The teaching - learning process has been dramatically altered by the convergence of a variety of technological, instructional, and pedagogical developments in recent times (Bonk & King, 1998; Marina, 2001; Smith, 2002). Garmer & Firestone (1996) concur that technology is challenging the boundaries of the educational structures that have traditionally facilitated and supported learning. Recent advances, especially in the area of computer technology, have heralded the development and implementation of new and innovative teaching strategies. Profound changes have been brought about by the Internet revolution which has significantly impacted our economy and has been hailed as the technological revolution of our time; providing innovative network and information access capabilities (O'Driscoll, 2003).

The availability of instant global communication systems has also changed the way we view written documents for learning. The decade has witnessed, the World Wide Web (WWW) has gain general popularity among the education community because of its low cost and ease of accessibility. The WWW has brought to everyone with Internet accessibility, the availability of on-line resources, allowing users to experience real personal interaction. Learning experiences involving more complex interactions between learners and instructional content can now be designed because of increased multimedia capabilities in computer technology (Reiser, 2001).

The increasing number of search engines eases searching the WWW. Information can be easily retrieved through issuance of simple word searches. Information professionals have also created directories, in nearly all subjects, of what is viewed as the most useful and appropriate in their respective disciplines (Barnard, 1997). The WWW also allows non-sequential linking of documents across the Internet resulting in a large pool of information (Macaulay, 2003).

It has become increasingly apparent, in instructional technology research, that one of the major, and possibly unique, consequences of instructional situations involving media is the possibility of the development of positive attitudes in students (Simonson & Maushak, 1996). Hovland, Janis & Kelley (1953) underscored the importance of exposing learners to new methods of instruction in order to influence their behavior towards learning. Compeau & Higgins, (1995) maintain the proposition that individuals will use media if they know it will contribute to a positive outcome in learning. In other words, the expected outcome of the behavior will influence an increase in liking or disliking the performance of the behavior.

This study thus set out to assess differences in attitude change, towards both computer technology, and the history of Western Civilization class for students using web-based resources and those using traditional textbooks. A second purpose was determine whether the level of computer literacy was a predictor of attitude towards computer technology. A pretest-posttest, non-equivalent control group design was used to test research hypotheses and the attendant answer the questions in this study.

Research Hypothesis 1

There is a statistically significant difference in attitude change, towards the History of Western Civilization class, between students who were instructed using web-based learning resources and students using the traditional textbook.

Research Hypothesis 2

There is a statistically significant difference in attitude change, towards computer technology, between students instructed using the web-based learning resources and students using the traditional textbook.

Research Hypothesis 3

Computer literacy is a predictor of attitude towards computer technology

Literature Review

Importance of Learner Attitudes

An important aspect of using instructional technology is the ability to compare the actual and anticipated impact it has on learning (Reiser, 2001; Chickering & Ehrmann, 1996). Instruction is geared towards two major goals: cognitive and attitude change in the learner. Understanding attitudes is crucial in facilitating interpretation of our surroundings, guiding behavior and organizing experiences in a meaningful way (Erwin, 2001). Henerson, Morris & Fitz-Gibbon (1978). Erwin (2001) acknowledge the complexity of measuring attitudes but also insist that attitude is an important construct and must be measured because of its usefulness in prediction of behavior.

In addition, Ajzen & Fishbein, (1977) assert that attitudes and beliefs play an important role in predicting human behavior. Apart from the fact that a positive attitude may impact learner achievement, Simonson & Maushak (1996) discuss four reasons why it is important to promote the right attitude among learners. First, there are times when learners must accept the truth of certain ideas. Second, students are more likely to remember what they learn, seek new ideas, and be motivated to study, when they develop positive attitudes towards an instructional situation. Third, the educator's awareness of which techniques affect attitude is important because there are times when it is not desirable to influence a student's attitude. Finally, the teacher can learn a great deal about how a particular situation impacts the learning process by measuring student attitude. With the proliferation of technology, educators in institutions of higher learning must seek to understand the evolution taking place in the learning arena so that they may: (1) appreciate the tools that are available to them; (2) learn how to use these tools to maximize learner outcomes; and (3) how to transform the learning environment to facilitate the use of the tools.

Defining Instructional Technology

For centuries, teachers have used objects, tools, and books to promote learning. Today, learning about and understanding the usefulness of the objects, tools and books, is termed instructional technology (Hains, Belland, Conceicao-Runlee, Santos, & Rothenberg, 2000).

Methods of instruction and instructional tools can be traced to the earliest civilizations (Saettler, 1968). While current instructional technology practices are scientific and research driven, the earliest methods were unscientific and depended on the educational theory and culture of the particular people involved. Saettler (1968) cites the years of 1918 to 1924 as the period of the emergence of audiovisual instruction, with visual instruction credited to the development of still and motion pictures. Development of instructional technology slowed down but picked up speed again during World War II. With the urgent need to speedily train a large number of soldiers, the government responded by creating and distributing training films and other mediated learning materials (Shrock, 1995). Seattler (1968) suggests that the greatest contribution to instructional technology during that time was the "development of the operator's view point and the first person commentary" (p.162). Post-World War II saw the evolution and development of educational radio and television (Raiser, 1987). Media has since played an important role in the teaching and learning process. The 1980's witnessed the development of the microcomputers, personal computers, and the rapid adoption of more sophisticated instructional technology methods (Shrock, 1995).

Computer and information technology have impacted the distribution and accessibility of information by eliminating the problems of time, schedules, and location. Modern use of instructional technology is changing the way people learn, work, and live (Garmer & Firestone, 1996; Marina, 2001). A wealth of information is available on the Internet along with a host of instructional media tools that enhance the educator's ability to build powerful, student-centered learning environments. Technology must be used and must have a fit with the tasks it supports to have a positive impact on the individual (Goodhue & Thompson, 1995).

Reiser (2001) suggests that the adoption of sophisticated technology offers diverse instructional capabilities and the ability to present information in a wide variety of forms. This allows learners to easily link to various content and has attracted the interest of instructional designers who are attuned to the paradigm shifts that are occurring.

Instructional Technology and the Paradigm Shift in Learning

In the past, learning relied largely on pedagogical theories that focused on teacher-directed approaches. This was based on the assumption that learners need to know only what the teacher teaches them, resulting in a teaching and learning situation that actively promotes dependency on the instructor (Knowles, 1984). Learning implied the transfer of knowledge from the teacher to a relatively passive student. The teacher was viewed as the content expert providing answers to all the learning needs of the students by taking complete control of the learning process. Indeed, , the teacher possessed full responsibility for making decisions about what was learned, how it was learned, when it would be learned, and how it would be assessed. Today, the paradigm has shifted and the teacher is viewed as a supporter and facilitator in a learner-centered environment. Learners are active participants constructing knowledge rather than just acquiring it. Students actively research the needed information by participating as expert/knowledge providers. The teacher is viewed as a coach and supporter who actively encourages students to use their personal knowledge and skills to create unique solutions to problems (Newby, Stepich, Lehman & Russell, 2000). The shift favors the philosophy of constructivism.

Constructivism, unlike the old school of thought that held that knowledge exists independently of the individual, subscribes to the fact that learners can construct their own knowledge based on past knowledge and experiences. Knowledge is constructed by enrichment procedures of the mind. This is evidenced by how well an individual reflects on his or her thinking, ponders questions, seeks answers to them, and uses the opportunity to experiment on the knowledge acquired (Ropnarine & Johnson, 1987). Rather than dictating what and how students learn, the teacher as facilitator instills a desire among students to learn by acting as a guide, and by encouraging students to exercise higher order thinking skills such as problem solving, reasoning, and reflection. Students therefore develop the ability to learn in cooperative and collaborative learning environments (McKeown & Beck, 1999). In essence, students become enthused about learning when given an opportunity to think problems through, asking questions and finding answers. Education, therefore, should move beyond the learner solely acquiring and integrating specialized knowledge. Learning should be vibrant, relevant, and exciting for the student, building environments where learners are actively engaged and

participate in hands on involvement. Instructional technology is an enrichment factor, which can have a great influence on how students learn, construct their own knowledge, and eventually become citizens who participate in life-long learning. Instructional design is a very important component of instructional technology (Raiser, 1987). A definition and discussion of instructional technology would not be complete without pointing out the role of design.

Importance of Instructional Technology in the Learning Process

The amount of technology in schools has increased significantly in the last ten years, (Reiser, 2001). Shelly, Cashman, Gunter, & Gunter, (1999) allude to the supposition that using technology in the classroom motivates and encourages students to become problem solvers (Shelly, Cashman, Gunter, & Gunter, 1999). In a study exploring the use of multimedia examination formats in undergraduate teaching, students embraced the interactive technology, and felt the incorporation of rich media in assessment could provide additional support for their learning and teaching (Liu, Papathanosiou & Hao, 2001). The study supports the definition of authentic and active learning. "Authentic learning experiences are instructional activities that demonstrate real-live connections by associating the concept being taught with a real life activity or event." (Shelly, Cashman, Gunter, & Gunter, 1999, p. 6.11). These same authors state:

> "Active learning provides students with the opportunity to be involved and interested in their own learning and gives them ownership of the information with which they are presented because they are actively involved in the learning process" (Shelly, Cashman, Gunter, & Gunter, 1999, p. 6.11).

Instructional technology offers this unique aspect of learning, wherein students are engaged in multiple learning contexts; incorporating visual, auditory, and kinesthetic learning processes. In such contexts, a variety of learning styles and individual needs are addressed making it easier to reach as well as benefit diverse groups of students. The learner is engaged in an active process that fosters the use of what is learned in other contexts and situations. At the same time the learner develops problem-solving skills that can be used in real-world situations (Lowe, 2002). Additionally, interactive technologies are engaging and can capture and hold learner attention thus giving students control of the flow of information. This enables them to review concepts, practice skills, and do in depth research. Well-implemented instructional technology programs engage learners and create excitement in the learning process. It can be a powerful tool for improving motivations and incentives for learning (Garmer & Firestone, 1996).

Student Attitude towards Instructional Technology

An important aspect in successful implementation of instructional technology is user acceptance, which may be influenced a great deal by users' attitude (Koohang, 1989). Actual contact, direct experience and more exposure to a stimuli object have a great impact on attitude (Erwin, 2001). Various studies have addressed the issue of student attitude toward instructional technology and specifically, computer technology and technologically enriched learning environments. A study by Mitra & Steffensmeier (2000) indicates that the students' attitude towards computers, their role in learning; and their ability to facilitate communication improved

when exposed to computer enriched environments. A longitudinal study of student attitudes toward computers found that when computer utilization increased, attitude and motivation to learning improved, which led to better performance on examinations (McKinnon, Nolan & Sinclair, 2000). Another study by Rothman (2000) on the impact of computer-based versus traditional textbook science instruction on selected student learning outcomes concluded that the use of instructional technology significantly improved student attitude toward science learning and English language development. A study evaluating college students' attitudes toward computers before and after taking a computer literacy course found that prior computer literacy helped improve student attitudes towards use of technology and learning (Taghavi, 2001). With more exposure to computers, students developed a more positive attitude and wanted to continue using the tool, resulting in creativity and a desire to take control of the personal learning process (Hopson, Simms & Knezek, 2002). Furthermore, computer enrichment was likely to contribute to a series of positive outcomes on their attitudes towards the process of learning, which could in turn have a positive outcome on learning itself. The findings of this study reflect on Compeau & Higgins (1995) statement that outcome expectations have a significant influence on individuals' reactions to technology.

The literature presented in this chapter addressed students' attitudes towards instructional technology and specifically web-based learning resources. In an era of constant change, technology adoption is taking top priority in higher education. For example, interactive technologies can be engaging and able to capture and hold learner attention. Well-implemented instructional technology programs will not only engage learners but also create excitement in the learning process, becoming a powerful tool for improving motivations and incentives for learning (Garmer & Firestone, 1996). Consequently, development of positive learning outcomes, and in this study, positive attitude in students must be a goal in adopting instructional technology.

Attitude is an important psychological construct that is indispensable in the learning process. As integration of instructional technology becomes a priority in higher education, more demands in its use are placed upon learners. An important aspect in successfully implementing instructional technology is user acceptance, which may be influenced a great deal by users' attitude. Finally, it appears that certain demographic learner characteristics influence attitudes towards the use of instructional technology.

Research Design and Methodology

Research Design

A pretest-posttest, non-equivalent control group design was used in this study. Such a design, popularly used in education and psychology studies, is appropriate for naturally assembled classrooms (Trochim, and Donnelly, 2006; Campbell & Stanley, 1963).

Study Subjects

Study subjects were drawn from a group enrolled in a Western Civilization class and using the same text book from three different universities: 38 from Bridgewater State College, Bridgewater, Massachusetts - USA, 70 from Massachusetts Maritime Academy, Buzzards Bay, Massachusetts - USA and 54 students from Clemson University, Clemson, South Carolina - USA. The treatment group was instructed using Web-based learning resources, whereas the control group was instructed on the basis of traditional print textbook. There were 108 students

instructed using Web-based support materials: 38 from Bridgewater State College, and 70 from Massachusetts Maritime Academy. The Web resources used by this group were published by the Interactive Learning Resource Network (iLrn), a division of Digital Learning Interactive. ILrn was a content management and delivery system that comprised multimedia-rich learning resources and course management tools within a robust online learning community. The control group consisted of 54 students from Clemson University. These students were instructed using the traditional or print textbooks (Noble *et al*., 1998). Cases that did not include both pre-test and post-test measures were omitted from the study. A total of 126 (78%) completed copies of the questionnaire out of the 162 that were initially given out provided the final data set analyzed.

Instrumentation

A scale was developed to assess the attitude of students toward computer technology. The scale was developed using items from the Texas Center for Educational Technology's Attitude towards Information Technology Survey (TAT), (Knezek & Christensen, 1997). Survey instrument was validated by four experts in the area on instructional technology. Cronbach's alpha reliability coefficient was 0.91.

Participants' attitudes' towards computer technology and the history class were measured by having the respondents indicate the level of importance they gave to selected questions and statements on a Likert-type scale. The response categories were (1) Strongly disagree, (2) Disagree, (3) undecided/unsure, (4) Agree and (5) Strongly agree. Differences in pretest and posttest attitude change, between the Web-based group and the traditional textbook group were assessed. The pretest survey instrument was distributed and administered to students in the beginning of the semester while the posttest survey instrument was distributed to students towards the end of the semester.

Data Analysis

All data analysis was performed using SPSS version 10 (1999). Frequencies, percentages and step-wise regression analysis procedure (Mogull, 2004) were used at $\alpha = 0.05$. To test for significant differences among the means, Analysis of Variance (ANOVA) for non-equivalent groups was used. Differences in means between the groups and within groups for the pretest and posttest were assessed for difference in significance. The F test using Analysis of Variance was used to determine if the differences were significant.

Results and Discussion

Results of the analysis for differences in attitude change towards the Western Civilization Class between students instructed using Web-based learning resources and students instructed using the traditional textbook indicated no statistically significant difference at alpha level of .05. Results of the analysis for differences in attitude change towards the history class and computer technology indicated no statistically significant difference at the .05 alpha levels.

Research Hypothesis 1

Results of the analysis for differences in posttest between the web-based and traditional groups indicated no statistically significant difference with alpha set at 0.05. The mean of the web-based group was 3.045 with a standard error of .449, while the mean of the traditional group was 3.119 with a standard error of .069. Summary statistics in Posttest Attitude towards Class are presented in Table 1.

Table 1: Summary Statistics for Difference in Posttest Attitude towards Class

Group	n	Means	Standard Error	*p*
Web-Based	84	3.045	0.045	.384
Traditional	42	3.119	0.069	

Research Hypothesis 2

Results of the analysis for differences in posttest between groups indicated no statistically significant difference at the .05 level between the web-based and traditional groups. The mean of the web-based group was 3.548 with a standard error of .038; while the mean of the traditional group was 3.468 with a standard error of .045. Summary statistics for difference in attitude change towards computer technology is presented in Table 2

Table 2: Summary Statistics for Difference in Attitude Change towards Computer Technology.

Group	n	Means	Standard Error	*p*
Web-Based	84	0.055	0.033	.851
Traditional	**42**	**0.044**	**0.047**	

N=126

Frequency Missing = 1

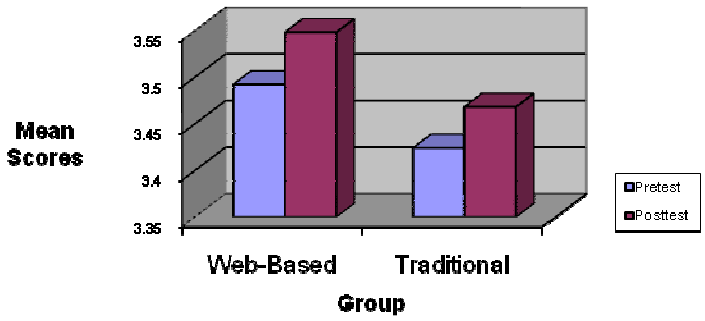

Figure showing Pretest-Posttest Results for Attitude towards Computer Technology

Research Hypothesis 3

Research Hypothesis 3 tested if computer literacy was a predictor of attitude towards computer technology. Regression analysis was used to address this question. The criteria variables in the regression were attitude towards class and computer technology. computer literacy was the predicator variable. Alpha was set at 0.05. Summary of Table 3 shows the regression of attitudes towards technology on computer literacy.

Table 3: Summary of Regression of Attitudes Towards Computer Technology on Computer Literacy (N= 119)

Variable	β	SE B	*p*
Intercept	3.141	.158	<.0001
Computer Literacy	.152	.062	.016*

*p = .05

Results from the regression analysis reveal a significance at p = 0.05 level of computer literacy as a predictor of attitude toward computer technology.

Discussion and Conclusion

Findings from the analysis suggest that there is no difference for students who used Web-based resources and those that used traditional textbooks as far as change of attitude towards computer technology, and the History of Western Civilization classes are concerned. This could

have resulted from the fact that even students using the traditional text book owned personal computers and used them frequently and were all computer literate.

The findings are supported by studies of (Macaulay, 2003; Gee, 1990; and Mayes, 1995). Lack of significant increase in attitude could have resulted from computer related anxieties and more specifically Internet related anxiety as reported by (Powers and Mitchell, 1997; Macaulay, 2003). Macaulay (2003) suggests that design principles, which will make computer technology and especially the World Wide Web more machine-human friendly need to be examined. Powers and Mitchell (1997) reported that student's perception was affected by the fact they found the Internet to be time consuming, Gee (1990) also reported that students found the Internet to be distracting. Further, added pressure is imposed on students when class outcomes are linked to technology.

These findings did not agree with those from other studies (Taghavi, 2001; Hopson, Simms & Knezek, 2002; Mitra & Steffensmeier, 2000; McKinnon, Nolan & Sinclair, 2000) who found a significant change in student attitude towards computer technology. A limitation in interpreting the results of this study was that it was unclear whether or not the students were trained in the specifics of using the technology. In addition, the majority of students in both Web-based and the traditional textbook groups owned personal computers and had Internet accessibility at their residence. It is therefore possible that the students using the traditional textbook utilized computers for some class work just as much as the students in the Web-resources group, a reason that could have accounted for the results obtained.

There was a relationship between computer literacy skills and computer technology. The Students with higher literacy skills posted high attitude towards computers (0.016). These findings support those of Busch (1995); Koohang (1989); Wishart (2002); Levin & Gordon (1989); Hall & Cooper (1991); and Liu, Papathanasiou & Hao (2001). Based on concurrence of research findings, it is thus tempting to conclude that students in Universities would greatly benefit from technology literacy courses prior to enrolling in courses in which computer use is a requirement. One may also conclude that these courses would increase computer literacy, consequently improving attitude towards learning.

In conclusion, the focus of this study was to determine whether there was any difference in attitude change towards both computer technology and the history of western civilization class between students using the web -based learning resources, and those using the traditional approach – textbook-based learning. In addition, the study sought to determine if computer literacy was a predictor of student attitude towards computer technology. Results from this study have shown no significant change in attitude towards computer technology and as well as towards the history of western civilization class between students using web based learning resources and the traditional textbook. However, computer literacy was found to predict student attitude towards computer technology.

These findings are a pointer to the need for higher institutions of learning (especially Universities) to consider incorporating computer literacy in the curricula, and to ensure that all students enrolling in all the programs undertake the course. Information communication technology has pervaded all sectors, education included and now drastically influencing trends in the teaching-learning environment both in the classroom situation as well as other learning environments such as open and distance. Given the technological changes briefly addressed

above, it is anticipated that findings from this study will be instructive towards integrating ICT in the teaching-learning process, especially at higher institutions of learning. However, as these hopes are entertained, it may useful to conduct more detailed research to assess the impact of various methods of teaching, and particularly effective use of computer technology in all disciplines with a view to preparing students to participate fully in the changing learning environment. Key research areas would include issues such as methodologies and procedures of incorporating technology in the classrooms, document success stories and best practices in order to encourage more usage and integration.

Reference

Ahern, T. C., & El-Hindi, A. E. (2000). Improving the instructional congruency of a computer mediated small group discussion: A case study in design and delivery. *Journal of Research on Computing Education*, 32(3), 385-400.

Ajzen, I., & Fishbein, M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychological Bulletin, 84*, 888-918.

Barnard, J. (1997). The World Wide Web and higher education: The promise of virtual universities and on line libraries. *Educational Technology, 37*(3), 30-47.

Bonk, C. J., & King, K. S. (1998). Electronic *collaborators: Learner centered technologies for literacy, apprenticeship, and discourse*. Mahwah: Lawrence Erlbaum Associates.

Chickering, A. & Ehrmann, S. C. (1996, October). Implementing the seven principles: Technology as lever. *AAHE Bulletin* 3-6.

Campbell, D. T. & Stanley, J. C. (1963). Experimental *and quasi-experimental designs for research*. Boston: Houghton Mifflin Company.

Compeau, D. R. & Higgins, C. A. (1995, June). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly, 19*(2), 189-211.

Erwin, P. (2001). *Attitudes and persuasion.* Hove: Psychology Press Limited.

Garmer, A. K. and Firestone, C. M. (1996). *Creating a learning society: Initiatives for education and technology*. Washington: DC: A Report of the Aspen Institute Forum on Communications and Society.

Gee, D. B. (1990). The impact of students' preferred learning style variables in a distance education course: A case study. *ERIC Document Reproduction Service* No. ED 358836.

Gentry, C. G. (1995). Educational technology: A question of meaning. In: G. J. Anglin (Ed.). *Instructional technology: Past, present and future (pp. 1-10).* Englewood: Libraries Unlimited.

Goodhue, D. L. & Thompson, R. L. (1995, June). Task-technology fit and individual performance. *MIS Quarterly,* 19(2), 213-236.

Hains, A. H., Belland, J., Conceicao-Runlee, S., Santos, R. M., & Rothenberg, D. (2000, Fall). Instructional technology and personnel preparation. *Topics in Early Childhood Special Education*. Retrieved on November 10, 2002, from http://www.findarticles.com

Henerson, M. E., Morris, L. L., & Fitz-Gibbon, C. T. (1978). *How to measure attitudes*. Beverly Hills: Sage Publications.

Hopson, M. H., Simms, R. L., & Knezek, G. A. (2002, Winter). Using a technologically enriched environment to improve higher-order thinking skills. *Journal of Research on Technology in education*, *34*(2), 109-119.

Hovland, C., Janis, I., & Kelley, H. (1953). *Communication and persuasion*. New Haven, CT: Yale University Press. http://www.findarticles.com/

Knezek, G. & Christensen, R. (1997). Teacher and student attitude towards information technology questionnaire. Retrieved January 2001 from http://www.tcet.unt.edu/research/index.htm

Koohang, A. A. (1989). A study of attitudes toward computers: Anxiety, confidence, liking, and perception of usefulness. *Journal of Research on Computing in Education, 22(2), 137-150.*

Liu, M., Papathanasiou, E., & Hao, Y. (2001). Exploring the use of multimedia examination formats in undergraduate teaching: Results from the field-testing. *Computers in Human Behavior, 17*(3), 225-248.

Lowe, J. (2001-2002, Winter). Computer-based education: Is it a panacea? *Journal of Research on Technology in education*, 34(2), 163-171.

Macaulay, M. (2003). The effects of web-assisted learning on student anxiety. *Journal of Educational Computing Research, 2*8(3), 221-230.

Maki, W. S. & Maki, R. H. (2002). Multi-media comprehension skills predicts differential outcomes of Web-based and lecture courses. *Journal of experimental Psychology: Applied*, 8, 88-95.

Marina, S. T. (2001, March). Facing the challenges, getting the right way with distance learning. *Ed at a Distance, 15*(30), 1-8. Retrieved on March 16, 2001, from http://www.usdla.org/ED_magazine/

Mayer, K. R., Coleman, J. J. (2000, Sept.). Student attitudes towards instructional technology in the large introductory U.S. Government course. Political Science & Politics. Retrieved on November 10, 2002 from http://www.findarticles.com

Mayes, R. L. (1995). The application of a computer algebra system as a tool in college algebra. *School Science and Mathematics, 95*(2), 61-68.

McKinnon, D. H., Nolan, D. J. P., & Sinclair, K. E. (2000). A Longitudinal study of student attitudes toward computers: Resolving an attitude decay paradox. *Journal of Research on Computing in education, 32(3). 325-335.*

Merino, D. N. & Abel, K.D. (2003). Evaluating the effectiveness of computer tutorials versus traditional lecturing in accounting topics. *Journal of Engineering Education, 92*(2), 189-194.

Mitra, A. & Steffensmeier, T. (2000). Changes in student attitudes and student computer use in a computer enriched environment. *Journal of Research on Computing Education, 32*(3), 417-433.

O'Driscoll, T. (2003). Proposing an optimal learning architecture for the digital enterprise. *Educational Technology*, 43(1), 12-19.

Powers, S. M. & Mitchell, J. (1997). Student perceptions and performance in a virtual classroom environment. (*ERIC Document Reproduction Service* No. ED 409005).

Raiser, R. A. (1987). Instructional Technology a History. In: R. M. Gagne (Eds.), *Instructional Technology Foundations* (pp 11-48). Hillsdale, NJ: Lawrence Erlbaum Publishers.

Reiser, R. A. (2001). A history of instructional design and technology: Part 1: A history of instructional media. *Educational Technology Research and Development, 49*(1), 53-64.

Rothman, A. H. (2000). The impact of computer-based versus 'traditional' textbook science instruction on selected student learning outcomes. *Dissertation Abstracts International*, 69(03), 938. UMI No. 9614309.

Saettler, P. (1968). *A History of instructional technology*. New York: McGraw-Hill Book Company.

Schwier, R. A. (1995). Issues in emerging interactive technologies. In: G. J. Anglin (Ed.). *Instructional technology: Past, present, and future* (pp. 119-130). Englewood, Colorado: Libraries Unlimited.

Shelly, G. B., Cashman, T. J., Gunter, R. E., & Gunter, G. A. (1999). *Teachers discovering computers: A link to the future*. Cambridge: Course Technology.

Shrock, S. A. (1995). A brief history of instructional development. In: G. J. Anglin (Ed.). *Instructional technology: Past, present, and future* (pp. 11-19). Englewood, Colorado: Libraries Unlimited.

Simonson, M. & Maushak, N. (1996). Instructional technology and attitude change. In: D. H. Jonassen (Ed.). *Handbook of research for educational communications and technology* (pp. 984 – 1016). New York: Macmillan LIBRARY Reference.

Smith, R. (2002). *Successfully incorporating Internet content and advanced presentation technology into collegiate courses: Lessons, methodology, and demonstration*. Unpublished manuscript, Massachusetts Maritime Academy.

Taghavi, S. E. (2001). Evaluation of college students' attitude toward computers before and after taking a computer literacy course. *Dissertation Abstracts International,* 62(02), 541. UMI No. 3005604.

Wang, A. Y., Newlin, M. H. (2000). Characteristics of students who enroll and succeed in psychology Web-based classes. *Journal of Educational Psychology*, 92, 137-143.