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DESCRIPTIVE STUDY OF STUDENTS' ATTITUDES TOWARD COMPUTERS AND ATTITUDES TOWARD COMMUNICATING ON COMPUTERS IN AN ELEMENTARY SCIENCE METHODS COURSE

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ABSTRACT

This research study was conducted in Indiana University in the fall semester of 1998-99 academic-years. The aim of the study was to analyze the affect of using telecommunication technologies on pre-service teachers' attitudes toward computers and their attitudes toward communicating on computers.

The telecommunication technologies integrated were Alta Vista Forum and Tapped In. Alta Vista Forum is an electronic conferencing program and Tapped In is a Multi User Virtual Environment. A survey was applied as pretest and posttest to observe attitudinal change of students.

Keywords: **Attitudes toward Computers, Attitudes toward Communicating on Computers, Telecommunication Technologies, Science Education.**

LITERATURE REVIEW

One factor in the successful implementation of computers in the classroom is users' acceptance, which in turn might be greatly influenced by users' attitudes. For this reason, students' attitudes toward computers have been studied with different samples and instruments by many researchers since the 1980s. Attitude has been found to be a predictor of the adoption of new technologies such as computers (Anderson et al., 1979). Positive teacher attitudes toward computers are widely recognized as a necessary condition for effective use of technology in the classroom (Woodrow, 1992).

In order to measure attitudes toward computers, Likert type attitude scales were developed, validated, and used in much of the published research. The Loyd's and Gressard's (1984a) Computer Attitude Scale (CAS) is the most extensively used scale with three affective dimensions: computer anxiety, computer confidence, and computer liking. Loyd & Loyd (1985) added a fourth dimension, computer usefulness. Nash & Moroz (1997) combined computer confidence and computer anxiety subscales and formed one computer confidence/anxiety subscale, then added one more factor, academic endeavors, associated with computer training.

In the end, CAS became a 34-item scale covering computer liking, computer usefulness, computer confidence/anxiety and attitude toward academic endeavors associated with computer training. Other computer attitude scales were developed by Bear et al. (1987), Chen (1986), Reece and Gable (1982), and Mitra (1998). For a comparison of these and many other attitude scales, one should see Woodrow (1991) and Gardner et al.,(1993).

Factors affecting students' and teachers' attitudes toward computers, and possible steps for improving their attitudes toward computers were also analyzed by many research

studies. Computer experience positively correlated with attitudes toward using computers (Koohang 1989, Hunt & Bohlin 1993). Computer training or computer instruction significantly decreased anxiety about computers while confidence and computer liking were increased (Gressard and Loly, 1985, Savenye et al., 1992, Kluever et al., 1994, Woodrow, 1992, Knezek et al., 1997). On the other hand, Boone and Gabel (1994) analyzed the computer attitudes of a sample of 150 undergraduate elementary education majors over a two-year technology-rich curriculum. Longitudinal survey data showed that students became less positive toward computers when one compared attitudes at the beginning of the teacher education curriculum to their attitudes near the end of the teacher education curriculum. Factors that might affect computer attitudes such as age and gender were also tested by many research studies (Hunt & Bohlin, 1993, Gressard and Loly, 1985, Loyd and Gressard, 1984a, Loyd & Gressard, 1984b).

In the last two decades, active use of the Internet in education has opened the door for using e-mail, bulletin boards, and other telecommunication technologies in teacher training. This has made it necessary to introduce and expose pre-service teachers to electronic network communications and collaboration systems which they can use in both their teaching and professional development. Furthermore, Task Force on Technology and Teacher Education emphasizes that teachers must participate in formal courses, some of which may be delivered in non-traditional ways, e.g., via telecommunications to become part of ongoing, informal learning communities with other professionals who share their interests and concerns. (Task Force on Technology and Teacher Education, 1997). In the last decade, schools of education have started to provide telecommunication facilities to increase the communication between pre-service teachers and faculty.

There is an increasing trend among faculty in teacher education programs to integrate telecommunication technologies into their instruction (Bishop-Clark & Huston, 1992, Johnson, 1996, Russet, 1995, Waugh & Rath, 1995, Norton & Sprague, 1997). E-mail or electronic conferencing systems are used to extend classroom discussions. Most of the instructors provide a web page for the course and deliver some material through the web. They also use e-mail or e-mail lists for communicating with students. Electronic conferencing systems are also used by an increasing number of faculty to support class discussion in asynchronous mode. An advantage of using such technologies as a support for conventional courses is that unlike face-to-face instruction or real time, teleconferencing allows one to choose when to respond.

This offers participants some time to think out a more structured, more complex response, as well as the benefit of being able to participate at times that are personally convenient (Romizowski & Mason, 1996). There is also evidence that telecommunication improves effective communication between students and instructors (Downing et al., 1988, Slovacek & Doyle, 1991, Durham & Sunal, 1991, Bishop-Clark & Huston, 1992, Stahlhut & Hawkes, 1991, Thompson & Hamilton, 1991), because e-mail is more convenient and appears to be less intimidating. Moreover, Hiltz (1986) found that students valued computer conferencing more highly when it was a supplemental activity of the course, not the main medium of instruction. Integration of telecommunication technologies into on-campus courses is relatively new and research on its usefulness is still lacking.

One study, which integrated telecommunication technologies into face-to-face instruction, was conducted by Tyan & Hong (1998). They integrated Virtual Classroom & Virtual Corporation System (VICTORY) into a Business Policy course at National Taiwan University. They reported that students expressed positive attitudes toward integrating computer-mediated communication learning style into the course. The students stated that using VICTORY facilitated out of classroom communication among learners and the instructor. They also reported that students who had a more successful, smoother experience getting on the Web had significantly higher satisfaction toward using VICTORY than students failed to get on the Web or who had to wait a long time before getting on.

A few studies comparing online courses with on-campus courses are the following. The first research was conducted by Turoff and Hiltz (1999). They compared traditional courses, online courses in which Virtual Classroom software was used, and some "mixed mode" courses. Courses were delivered by the same instructor using the same course materials, midterms and final exams, but students chose the delivery mode. Students who used Virtual Classroom perceived it to be superior to the traditional classroom in a number of ways such as convenient access to educational experiences, increased participation in the course, improved ability to apply course material in new contexts and to express their own ideas relating to the material, improved access to their professor, improved attitudes toward the use of computers and greater knowledge of the use of computers.

Another study, comparing on-campus, computer conferencing, and traditional correspondence instruction, was conducted by Cheng et al. (1991). According to their results, different instructional methods did not affect the groups' performance. In general, conferencing and correspondence students spent more time on task than did the on-campus students. But more detailed analysis showed that the computer conferencing mode did not slow down the users while they were learning the material and working on projects. All of the participants had higher scores on the attitudes toward computers when compared to the beginning, which implied that the course positively affected their attitudes toward computers. When they compared the students' final attitudes toward computers in all groups, they could not find any significant differences. They were basically positive. However, the computer conferencing group responded somewhat less positively than the on-campus group toward the course and outcomes of the course on the final attitudes questionnaire. They concluded that these attitude results might reflect some frustration on the part of the computer conferencing students toward using computer networks and the inherent difficulties of learning course content in this manner.

There is an increase in the integration of telecommunication technologies into different teacher education courses. Nevertheless, there is a lack of research into the use of telecommunications in teacher preparation. Russet (1995) and Brownell (1997) pointed out the need for increased research into using telecommunications in teacher preparation to understand how technology affects student-instructor interactions and the attitudes of students and faculty.

METHOD

This study focused on the analysis of pre-service teachers' attitudes toward computers and attitudes toward communicating on computers in an Elementary Science Methods Course. This course was an on-campus course, and two telecommunication technologies, Alta Vista Forum (AVF) (1998) and Tapped In (Schlager, 1996) were integrated to extend the interaction of the students with each other and with the instructor. A survey was administered at the beginning and at the end of the semester to observe if there is a change in the students' attitudes toward computers and their attitudes toward communicating on computers.

Four sections of the course were used in this study. In two sections, telecommunication technologies were integrated and this group was called Group A. In the other two sections those telecommunication technologies were not integrated and this group was called Group B. All students in both groups used computers for several purposes; because Indiana University provides enough computer support and almost all of the instructors require students to use computers for word processing, Web searches, e-mail etc. Instructors of Group A and Group B were different. Group B was used to compare Group A's attitudinal changes toward computers and communicating on computers. More control over the use of computers and over Group B was not possible. It was impossible to say

the other instructors not to use computers in their classes. It was impossible to say students not to use e-mail and web for personal purposes or for word processing. Conducting controlled experimental studies in social environments is very difficult, thus the researchers should be careful in using inferential statistics and make inferences for larger populations. For all of these reasons, the researcher did not apply inferential statistics, she described and compared both groups at the beginning and at the end of the semester by using descriptive statistics. Hence the researcher called this study as a comparative case study, which is the comparison of two cases, Group A, and Group B. Description of both groups are the following.

Group A

Group A consisted of 43 students; four male and 39 female. The students' ages ranged from 20 to 40 with an average of 21.9. Twenty-two of the students were seniors, 20 juniors, and one sophomore. There were 16 students from Language Arts/Humanities, 22 students from Social Sciences, one from Mathematics, one from Art, and three from Music.

Group A there were 42 students in this group; seven male and 35 female. There were 25 juniors and 17 seniors in the Group B. The students' ages varied between 19 and 32, with an average of 21.06. The majority of students had majors in Language Arts/Humanities (20) and the Social Sciences (10). There were seven Mathematics majors, four Science majors, and one Special Education major.

The Telecommunication Technologies Integrated

The two telecommunication technologies integrated in this research study were AVF and Tapped In. AVF is an electronic conferencing system used for extending class discussion and communication among students. Tapped In, Teacher Professional Developmental Institute, is a Multi User Virtual Environment (MUVE).

Alta Vista Forum

AVF was made available by Indiana University. It is a structured storage and management area for documents, and is accessible through the Internet with any standard browser. AVF stores documents for universal access by team members or other authorized users, and also permits annotations and discussions around the documents. AVF allows team members in different locations to quickly create document-sharing processes and discussion forums to match the task at hand. Users can initiate team discussions or add comments to topics and messages posted by others; multiple levels of reply are supported. The messages or replies were stamped with the identity of its originator, the date and the time. Users can upload files like spreadsheets, graphics, and text documents or supply hotlinks to integrate this information into discussions. When topics or files are posted, submitters are asked to enter an abstract describing content, categorize the information as desired, and provide keywords. This enables the AltaVista Search facility to organize discussions by subject, keywords, or contents. For time-sensitive team collaboration, AVF also supports real-time text chatting.

Tapped In

Tapped In, Teacher Professional Development Institute, is a Multi User Virtual Environment (MUVE). It is designed like a virtual conference building with the conference rooms and the reception area on the first floor. There are virtual offices for members on the upper floors. Every member can create their own virtual office, decorate it, and communicate with others via the chat window, or collaborate by using all of the facilities provided by Tapped In.

Since one of Tapped In's purposes is to create an electronic community among educators, there is always a person at the "reception" during working hours to help newcomers get used to the environment or to help members feel they are a member of an electronic community.

Members organize after school online conferences on Tapped In; interested people connected to Tapped at the reported time and they communicate and collaborate by using the chat window and they may point out web sites to others.

Integration of Technologies

Group A started to use AVF in the third week of the semester. Two course sessions were allocated to training the students. The instructor also provided technical support throughout the semester when asked. In order to provide hands on experience with AVF, first electronic discussion of the course was chosen to be an interesting subject for everyone, pros and cons of technology use in education. The instructor posted two speeches which hold different perspectives on technology use in education.

The students were asked to read two speeches on this issue, to post their comments on AVF, and to respond to others' postings. After that, AVF was used by the students in Group A to submit some of their homework so their classmates could see each other's work and also respond or to contribute to electronic discussions started by the instructor on course topics. The students shared their experience in the schools during their field experience with their classmates. Group A's instructor sometimes used AVF to post class readings.

Tapped In was introduced to the students at the last two weeks of the semester to inform them availability of such technologies that they can use in their professional development. The Students were encouraged to join after school online conferences on Tapped In.

Data Collection

Quantitative data were collected by pretest and posttest administered to both groups at the beginning and end of the semester.

Instrument

A survey which was developed by Mitra (1998) administered to both groups at the beginning and end of the semester. The survey was modified for this research project by changing the wording of some items and excluding some other items. This survey was selected because it contained many items concerning online services, the Internet, communication on computers, in addition to items concerning attitudes toward computers.

All the items in the survey were Likert type items with six categories: Strongly Disagree, Disagree, Barely Disagree, Barely Agree, Agree, and Strongly Agree. These categories were coded 1, 2, 3, 4, 5, and 6 respectively. Negatively worded items were reversed. The researcher constructed two subscales from those items.

First subscale was called Attitudes toward Computers Subscale. The eight items in this subscale involve students' attitudes toward computers such as, whether they feel comfortable, apprehensive, or neutral about computers, and whether they find them helpful in their learning and understanding of the course material.

These items were combined to measure students' attitudes toward computers. The reliability (coefficient alpha) of this subscale was 0.86.

Second subscale consisted of ten items that emphasized communicating on computers. This scale was called as Attitudes toward Communicating on Computers Subscale. All of the items in this subscale concern communicating on computers.

Some of them probe whether students found such communication effective in both course and non-course related contexts, if students feel comfortable or apprehensive about communicating on computers. The reliability (coefficient alpha) of this subscale was 0.82.

RESULTS AND DISCUSSION

The Students' Attitudes toward Computers

Descriptive statistics for Group A are represented in Table 1. The mean of Group A was 4.44 at pretest decreasing to 4.18 at posttest. There were six categories on the subscale: Strongly Disagree, Disagree, Barely Disagree, Barely Agree, Agree, and Strongly Agree coded from one to six respectively. Thus the average response fell between Barely Agree and Agree at both pretest and posttest. The students in Group A were already positive toward computers at the time of the pretest and stayed positive at the end of the study. The difference between pretest and posttest mean values in Group A was very small. It was concluded that there was no change in the students' attitudes toward computers from pretest to posttest.

Table: 1
Descriptive Statistics for Group A on the Attitudes toward Computers Subscale

Group A	N	Minimum	Maximum	Mean	Student Error of the Mean	Studdent Deviation
Pretest	43	2.88	5.88	4.44	.11	.75
Post test	42	1.57	5.50	4.18	.13	.82
Valid N (list wise)	42					

The average values for Group B were calculated in the same way as they were for Group A and are represented in Table 2. The mean for Group B at the pretest was 4.25 while the mean at the posttest was 4.36. The change from pretest to posttest was again very small. It was concluded that there was no change in Group B's students' attitudes toward computers.

Table: 2
Descriptive Statistics for Group B on the Attitudes toward Computers SubscaleGroup B

	N	Minimum	Maximum	Mean	Student Error of the Mean	Student Deviation
Pretest	42	2.75	5.38	4.25	0.10	.62
Posttest	36	3.14	6.00	4.36	0.09	.55
Valid N (list wise)	36					

Group means were graphed in Figure 4 to clearly show the progress of both groups from pretest to posttest. Were very small and might be caused by measurement errors.

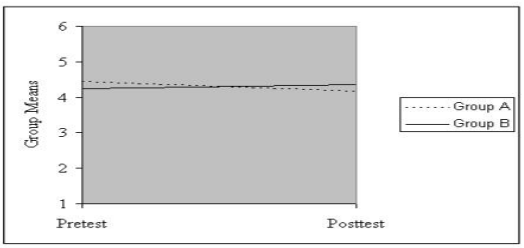

Figure: 1
Group Mean Scores for Group A and Group B on the Attitudes toward Computers Subscale at pretest and posttest.

As can be seen from the Figure 4 both groups were positive at the beginning of the study and stayed positive at the end of the study.

The changes in both groups.In conclusion, almost no change was observed in both groups from pretest to posttest on Attitudes toward Computers Subscale.

There are two research results in the literature. Turof & Hiltz (1999) and Cheng (1991) reported that using telecommunication technologies increased students' attitudes toward computers in a positive way. In this study, the group using telecommunication technologies did not show a considerable change from pretest to posttest in their attitudes toward computers.

Of course, this outcome depends on many factors such as the technologies used, whether the students are at a distance or not, the way they are integrated, etc.

The Students' Attitudes toward Communicating on Computers

Table: 3 represents Group A's values for descriptive statistics on the Attitudes toward Communicating on Computers.

The mean of Group A at the pretest was 5.26 and it was 5.21 at the posttest. This difference is so small that it could be caused by anything. Thus it was concluded that telecommunication technologies used in this course did not affect the students' attitudes toward communicating on computers.

Table: 3
Descriptive Statistics for Group A on the Attitudes toward Communicating on Computers SubscaleGroup A

	N	Minimum	Maximum	Mean	Std. Error of the Mean	Std. Deviation
Pretest	43	4.10	6.00	5.26	0.08	.53
Posttest	42	4.10	6.00	5.21	0.07	.48
Valid N (listwise)	42					

Group B's mean scores at the pretest and posttest are shown in Table 4. Forty-two students participated at pretest. The mean was 5.21 at the pretest. This decreased slightly to 5.19 at posttest, but again the difference is very small. There was almost any change in the Group B's attitudes toward communicating on computers from pretest to posttest.

Table: 4
Descriptive Statistics for Group B on
the Attitudes toward Communicating on Computers Subscale

Group B	N	Minimum	Maximum	Mean	Student Error of the Mean	Student Deviation
Pretest	42	4.30	6.00	5.21	0.06	.42
Posttest	36	4.40	6.00	5.19	0.07	.40
Valid N (list wise)	36					

The group means of Group A and Group B are presented in a graph, Figure 6, to show visually how the groups changed from pretest to posttest.

As can be seen from Figure 6 both Group A and Group B became slightly less positive in Attitudes toward Communicating on Computers Subscale but the changes in the mean scores were very small and do not provide any conclusive indication of the effects of technologies used in Group A.

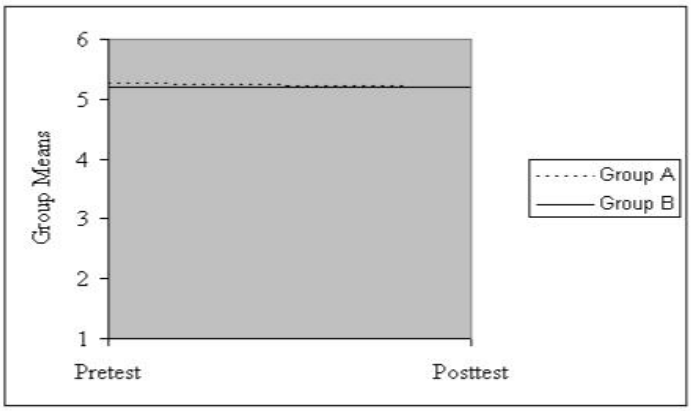

Figure: 2
Group Mean Scores for Group A and Group B on the
Attitudes toward Communicating on Computers Subscale at pretest and posttest.

In conclusion, both groups were already very positive in their attitudes toward communicating on computers and stayed very positive through the end of the study. Group A's pretest mean on the Attitudes toward Communicating on Computers Subscale

was 5.26 while Group B's was 5.21. These mean values fell between Agree and Strongly Agree in the six-point scale.

The reasons for the students being very positive about communicating on computers might be the active use of e-mail at Indiana University. Indiana University provides each student with an e-mail account when they register. The use of e-mail by students has become a norm. Every department at IU uses e-mail actively.

Table: 5
Descriptive Statistics for Categories of Computer Use

	N	Minimum	Maximum	Mean	Std. Error of the Mean	Std. Deviation
E-mail with friends	84	3	5	4.80	.05	.46
Word processing	85	1	5	4.71	.07	.67
Using the Internet to get information	85	2	5	4.42	.08	.76
E-mail with classmates	85	2	5	4.31	.09	.83
E-mail with teachers	85	2	5	4.28	.09	.73
E-mail with family	85	1	5	4.21	.12	1.15
E-mail with student organizations	85	1	5	3.19	.15	1.39
Spreadsheet	85	1	5	2.41	.13	1.17
Online collaboration	85	1	5	2.39	.13	1.21
Drawing	84	1	5	2.11	.10	.93
Database management	84	1	5	2.08	.12	1.08
Mathematical computing	85	1	5	2.00	.10	.93
Statistical computing (e.g. probability statistics)	84	1	4	1.73	.10	.88
Music production & writing	85	1	4	1.53	.09	.83
Video production & writing	84	1	4	1.50	.09	.84
Valid N (list wise)	81					

In the School of Education, the first thing that the instructors do in a course is to request the e-mail addresses of the students enrolled in the course. Most of the instructors frequently use e-mail to communicate with their students. Thus students get accustomed to the active use of e-mail for both their courses and for other purposes.

In the pretest, there was a question about how frequently they used computer applications such as word processing, spreadsheet, database management, and so on. There were five categories in the scale: Never, Very Infrequently, Infrequently, Frequently, And Very Frequently. The students used computers most frequently for e-mail with their friends (4.80). This explained why the students in both groups were very positive toward communicating on computers. The next one was word processing (4.71). Using the Internet to get information came third (4.42). The next four were all e-mail usage in decreasing order: e-mail with classmates (4.31), e-mail with teachers (4.28), e-mail with family (4.21), and e-mail with student organizations (3.19). Spreadsheets came next in the list with a mean of 2.41.These categories were coded from 1 to 5 respectively.

Results are summarized in Table: 5. The other computer uses in decreasing order were: online collaboration (2.39), drawing (2.11), database management (2.08), mathematical computing (2.00), statistical computing (1.73), music production and writing (1.53), video production and writing (1.50).

CONCLUSION

In conclusion, the use of telecommunication technologies in this study did not affect students' attitudes toward computers and their attitudes toward communicating on computers. The students were already positive about computers and communicating on computers and stayed positive at the end of the study.

Task Force on Technology and Teacher Education (1997) emphasized that teachers need an "attitude" that is fearless in the use of technology, encourages them to take risks, and inspires them to become lifelong learners. This research study also demonstrated that pre-service teachers participated in this study has a high attitude toward computers and toward communicating on computers which might indicate that they might use such technologies in their professional life.

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