Students’ attitudes on the use of Internet telecommunication tools for the purpose of collaborative and discussion activities in support of an online Problem Based Learning (PBL) model.

Othman Ismail, PhD
Academy of Language Studies
Universiti Teknologi MARA Shah Alam

Noraini Ahmad Basri
Senior Lecturer, Academy of Language Studies,
Universiti Teknologi MARA, Shah Alam

Ismie Roha Mohamed Jais
Senior Lecturer, Academy of Language Studies,
Universiti Teknologi MARA, Shah Alam

Abstract:
The purpose of this study was to investigate students’ attitudes on the use of Internet telecommunication tools for the purpose of collaborative and discussion activities in support of an online PBL model. The research questions examined if perceived knowledge and skills, number of hours spent on Internet telecommunication tools and remote interaction and cooperation used for collaborative and discussion activities in support of the online PBL model, helped or hindered the students' attitudes toward Internet telecommunications; and, whether or not these variables predicted the students' attitudes toward Internet telecommunications. An experimental and a descriptive research design using a survey instrument was applied. Fifty-eight (58) randomly selected subjects participated in the study conducted at the Department of C&I, SIUC, Illinois, USA. The finding showed that the experimental group students (n=16) revealed that there was a significant difference (p < .05) on attitudes toward computer telecommunications. Another finding indicated that the remote interaction and collaboration variable (INTCOLL) was found to be a significant predictor of attitudes toward computer telecommunications. The F value was computed at 7.86 (p < .01). In conclusion, it is crucial that prompt support and assistance be provided to the students if one is to nurture positive attitudes. With proper guidance, right attitudes and adequate access to the use of technology, students can be coached to use computers for collaborative activities to explore the richness of global knowledge and new experience that will broaden their horizons.
INTRODUCTION

Technology in education has a more profound impact on today’s youth than the generation before. It has definitely shaped students’ attitudes, perceptions, computer experiences, learning approaches, gender effects and ways of communication. There are many factors that influence users’ attitudes toward computers. Numerous definitions and categories have also been suggested for attitudes that include “acceptance, affect, cognition, comfort, confidence, courses, interest, liking, locus of control, motivation, programming, training, case scenarios and stereotypes” (Kay, 1992 as cited in Mitra, 1998). A typical definition used with computer anxiety is “the fear or apprehension felt by an individual when using computers, or when considering the possibility of computer utilization” (Simonson, Maurer, Montag-Torardi & Whitaker, 1987). Gender, age, and years of education are some factors believed to be related to attitudes (Morris, 1988-1989). Hence, understanding students’ attitudes towards using the computers for educational purposes is significant to ensure that our students’ educational experiences would be more meaningful.

In a collaborative learning model, learners are responsible for their own learning and the learning of others (Johnson & Johnson, 1990). Collaborative learning as reported by Kitchen and McDougall (1998-1999) can increase students’ academic achievement, inter-group relations, diversity awareness, individual self-esteem, and high level thinking. Cohen and Miyake (1986) stated also that in the learning process the bulk of constructive criticism occurs while learning in collaboration. The experiment showed that about 80 percent of self-reflection took place during collaborative learning compared to 20 percent that took place when students were learning alone. The collaborative method also encourages the development of knowledge, a more abstract understanding and a greater skill development in the students that allows them to participate actively and move them away from being passive participants in the classroom (Alavi, 1994).

Piaget (1928) pointed out that collaborative learning has a major role in constructive cognitive development. He felt that interactions between peers are equally shared. Students feel that they have their peers to help them develop more understanding of the learning materials rather than to challenge them. In addition, students share new information or create information through collaboration. Piaget’s theory is consistent with other popular learning theories in emphasizing the importance of collaboration. For example, Vygotsky’s (1987) zone of proximal development (ZPD) argues that students learn to solve problems and arrive at mutual decisions by employing group socialization and discussion. Through scaffolding, children can increase their cognitive development faster.

A Problem Based Learning (PBL) model focuses on the investigation and resolution of ill-structured, messy, authentic real-world problems (Illinois Mathematics and Science Academy, 1999). The nature of the problem demands that the learners explore using inquiry and systematic investigation. The real-world problem serves as the organizing center and context for the learning process. Students are the owners of both the problems and the resolutions. The authentic nature of the problem drives the students to be interested and motivated to find the best solutions. Teachers are facilitators, not information providers. Their responsibility is to facilitate and coach the students towards achieving the broader goals of the Problem Based Learning. By adapting the on-line PBL model, this research study intends to investigate students’ attitudes on the use of collaborative and discussion activities in resolving the Problem Based Learning task.
Purpose of the Study

The purpose of this study is to investigate the students’ attitudes on the use of Internet telecommunication tools for the purpose of collaborative and discussion activities in support of an online PBL model.

Statement of Problems

Today, telecollaborative learning activities via the Internet is easy to conduct. In a classroom, a resourceful teacher can use the Internet as a tool for students to telecollaborate with other students elsewhere on a cyber-class problem-solving project. The teacher, for example, can use a chat room, an audio or video conferencing room, that permits students to discuss problems, gather and exchange ideas, collect data and provide solutions or action plans to solve any assigned task.

The issues of students’ perceptions towards technology, their active involvement and their participation in online collaborative learning activities are still much to be desired. Often, students are not motivated to use the technology due to many reasons. Some do not have the right attitudes towards using the technology. Some argue that they do not have the appropriate technology supports and facilities. Many feel that they do not have the knowledge and skills needed to actively participate in the learning tasks. Some feel that they do not have the time to commit to telecollaborate activities due to other commitments.

As for the use of computer technology for collaborative and discussion learning activities, understanding the students’ attitudes is significant to ensure that our students’ learning experiences can be motivated and made more meaningful.

Research Questions and Rationale

This study addressed the following objective and research questions.

I. To determine if perceived knowledge and skills, number of hours spent on Internet telecommunication tools and remote interaction and cooperation used for collaborative and discussion activities in support of the online PBL model, help or hinder the students’ attitudes toward Internet telecommunications.

A. Did the experimental groups show more positive attitudes toward using the telecommunication tools for collaborative and discussion activities than the control groups before and after the treatment?

1. Ho: $\mu_{\text{ExpConAttitudePost}} - \mu_{\text{ExpConAttitudePre}} = 0$
   Ha: $\mu_{\text{ExpConAttitudePost}} - \mu_{\text{ExpConAttitudePre}} \neq 0$

2. Ho: $\mu_{\text{ExpAttitudePost}} - \mu_{\text{ExpAttitudePre}} = 0$
   Ha: $\mu_{\text{ExpAttitudePost}} - \mu_{\text{ExpAttitudePre}} \neq 0$

3. Ho: $\mu_{\text{ConAttitudePost}} - \mu_{\text{ConAttitudePre}} = 0$
   Ha: $\mu_{\text{ConAttitudePost}} - \mu_{\text{ConAttitudePre}} \neq 0$
4. \[
\begin{align*}
\text{Ho: } & \mu_{\text{ExpAttitudePost}} = \mu_{\text{ConAttitudePost}} = 0 \\
\text{Ha: } & \mu_{\text{ExpAttitudePost}} - \mu_{\text{ConAttitudePost}} \neq 0
\end{align*}
\]

**Primary Hypothesis:**

**B.** Did the perceived knowledge and skills, number of hours spent on Internet telecommunication tools used for collaborative and discussion activities, and remote interaction and cooperation predict the students' attitudes toward Internet telecommunications?

**FM:** \[
\text{AttitudeHat} = a + b_1\text{KSync} + b_2\text{KAsync} + b_3\text{FreqSync} + b_4\text{FreqAsync} + b_5\text{IntColl}
\]

**RM:** \[
\text{AttitudeHat} = a \quad \text{where } a = \text{AttitudeHat (mean of Attitude)}
\]

**Secondary Hypothesis:**

1. Did the perceived knowledge and skills on Internet tools used for discussion activities influence the students' attitudes towards Internet telecommunications holding the number of hours spent on t/c activities, and remote interaction and collaboration constant? (That is: \( \rho^2 \text{Attitude KSync } \text{KAsync } \text{FreqSync } \text{FreqAsync } \text{IntColl} \))

2. Did the number of hours spent on Internet tools used for discussion activities influence the students' attitudes toward Internet telecommunications holding knowledge and skill, and remote interaction and collaboration constant? (That is: \( \rho^2 \text{Attitude FreqSync FreqAsync } \text{KSync } \text{KAsync } \text{IntColl} \))

3. Did the remote interaction and collaboration used for discussion activities influence the students' attitudes toward Internet telecommunications holding knowledge and skill, and the number of hours spent on synchronous activities constant? (That is: \( \rho^2 \text{Attitude IntColl } \text{FreqSync FreqAsync } \text{KSync } \text{KAsync} \))

**Significance of the Study**

The study on students’ attitudes on the Internet telecommunication tools used for collaborative and discussion activities with an online PBL model is significant. This is because it can provide valuable information and findings towards understanding our students’ learning motivation. Audio and video telecommunication activities over the Internet, today, can provide alternative media for human interaction, collaborative discussion and cooperation. The availability of audio and video teleconferencing software has encouraged Internet users to conduct cyber-appointments and meetings, to collaborate on school or business projects and to communicate regularly across physical boundaries. Information and findings regarding these collaborative and discussion activities are significant for the planning of future direction in incorporating technology in classroom settings. In addition, these research findings on the students’ attitudes will be important because it can shed light on how teleconferencing activities can be capitalized for the betterment of our future education.
LITERATURE REVIEW

Attitudes

What are the Students’ Attitudes toward Computer Technology?

There are many factors that influence users’ attitudes toward computers. Zhang and Espinoza (1998) examined the relationship of computer self-efficacy, attitudes and desirability of learning computing skills. Their subjects were 220 students taking three computer classes and one non-computer class at a university in the southwest United States. In the study, they reported that advanced computer skills contributed significantly to the prediction of desirability of learning computing skills. Attitudes toward computers and computer self-efficacy had a significantly combined predictive effect on desirability of learning computing skills. Zhang and Espinoza found that self-confidence and motivation also assist in developing positive attitudes towards computers. They concluded that educators should inform students of the usefulness of computer technology in the information age and they should encourage students to employ computers as means for information retrieval and delivery, telecommunicating, telecollaborating, and other computer-related activities.

Johnson (1991) stated students’ attitudes toward, and perceptions of computers are based on the assumptions that the alternative media of instruction offers better or more interesting ways of learning than the conventional methods. Often, users who perceive themselves as experts or competent computer users feel more confident in applying different computer-related activities than those who perceive themselves as beginners or novices. Perceptions are shaped or influenced by factors such as the students' interest and eagerness to explore new technology, motivation, self-confidence and endurance to study new things as well as the students’ attention and views towards technological innovations (Ismail, 1994).

Mitra (1998) conducted a survey on categories of computer use and attitudes influence toward computers. His study was comprised of first-year students at Wake-Forest University. A response rate of 34 percent resulted in 1,444 completed surveys collected for the research purpose. One of the objectives of the study was to look at the relationship between specific categories of computer use and attitudes towards computers. Five specific areas of computer use for different tasks were explored: (a) use of the Internet for task-based purposes, (b) use of networks for non-task purposes, (c) use of computers for data-management operations, (d) use of computers in mathematical computations and (e) use of computers for word processing. Computer use was defined and conceptualized to be “an act where the user engages in applications that are often centered around the computer, which become the end rather than the means to an end” (Mitra, 1998, p. 282). The study reported that there were attitude differences among the groups based on computer use (p< 0.01). Higher [computer] users showed a higher positive mean attitude score in all categories of computer use.

According to McMahon, Gardner, Gray and Mulhern (1999), support and information for computer users were two factors that influence students’ perceptions towards computer use. A student survey and interviews with students (focus groups) and staff (one-to-one) were used on a group of 835 first year cohort students entering seven faculties of a United Kingdom university. The researchers reported that the students felt that support when actually using the computers was inadequate. Instead, knowledgeable friends or other students using the computer facilities acted as resource persons when computer assistance was required. Help from members of the academic staff was difficult to obtain.
Do Students’ Perceived Knowledge and Skills influence Their Attitudes toward Computer Technology?

Computer use can be associated with the frequent use of different types of computer applications and the length of time that the learners spend interacting or working on the computer. Knowledge and skills possessed by learners have positive impacts on the learners’ attitudes toward computers (Zhang and Espinoza, 1998). For instance, Mitra (1998) wrote that there was a relationship between students’ attitudes and the duration of time spent using the computers. Learners also experienced a positive shift of attitudes after they had undergone a period of training.

According to McMahon et al. (1999), adequacy of computer training, access and time to use computer resources were other factors that influence students’ perceptions towards computer use. The researchers reported that lack of computer training has been perceived as the most important factor that hinders computer use. Most students in the study believed that computer training in the university was generally inadequate. In addition, the study also indicated that computer access time and availability were other factors that influence students’ perceptions towards computer use. Students often felt annoyed and frustrated especially when they could not have access to computers during peak hours or approaching course work deadlines.

Other research studies reported that students did experience a positive shift in attitudes towards the computer after they had undergone a period of training. Rosen and Maguire (1990) conducted a meta-analysis of nine empirical studies with college students. They reported that computer experience seems to reduce computer phobia and hence contributes to positive attitudes to computers.

Collaborative Learning and Technology

What is Collaborative Learning?

Kaye (1992) defined collaborative learning as “establishing ‘added value’ and new understanding amongst new members of the group. Etymologically, to collaborate means to work together, which implies a concept of shared goals … to create something new or different through collaboration, as opposed to simply exchanging information or passing on instructions” (p. 2). Collaborative learning thus provides an environment to improve and stimulate the learning process. This environment assures that the students will be motivated to learn; and as such, this learning environment will produce more successful students. By creating a more natural learning environment, it is hoped that students will sustain interest in learning.

In a collaborative learning model, learners are responsible for their own learning and the learning of others (Johnson & Johnson, 1990). Collaborative learning as reported by Kitchen and McDougall (1998-1999) can increase students’ academic achievement, inter-group relations, diversity awareness, individual self-esteem, and high level thinking. Cohen and Miyake (1986) stated also that in the learning process the bulk of constructive criticism occurs while learning in collaboration. The collaborative method also encourages the development of knowledge, a more abstract understanding and a greater skill development in the students that allows them to participate actively and move them away from being passive participants in the classroom (Alavi, 1994).
Internet Telecommunication Activities

What are Internet Telecommunication Activities?

With the present cutting-edge technology, stand-alone computers can be used for telecommunication purposes - both as client machines and server solutions. Microcomputers today can perform effective telecommunication functions such as audio conferencing, chat, voice and video mail. Computer users can now communicate remotely on-line and in real-time with other users globally across all geographical boundaries. All these Internet telecommunication activities are now possible everywhere -- at home, in schools, at non-profit organizations and at business enterprises.

In general, the Internet is used for a variety of functions. Cullum (2000) classifies the functions of the Internet into three different categories: 1) communications, 2) information, and 3) World Wide Web (WWW). Internet activities such as electronic mail, bulletin board systems, chat rooms, audio and video conferencing are categorized as having the communication function. These telecommunication activities allow users to communicate synchronously and asynchronously.

The Internet can also be used as an information retrieval medium. File Transfer Protocol (FTP) and Fetch are two types of programs that permit Internet users to upload as well as download files and folders remotely. The World Wide Web is another Internet information retrieval service available for Internet telecommunication activities. Information provided over the WWW is developed, designed and published using a variety of HTML editors. By using the Internet browsers such as Netscape and Explorer, users can browse the Internet for all kinds of information. On-line library resources are examples of information that can also be retrieved via the Internet. Many educational institutions provide library resources that can be retrieved easily. For instance, Internet users around the world can access the library databases to retrieve extensive collections of educationally published materials.

Computers can be used as tools that can support teaching and learning activities in our classrooms. As such, they can never replace the function of good educators in our classrooms. Nevertheless, they can be capitalized to assist in the business of schooling - teaching and learning (Ismail, 1994). For instance, computers can be used for basic tasks such as using word processing, maintaining databases of information, designing graphics and developing spreadsheets. Computers can also be used as aided instructions such as Computer-Aided-Instruction (CAI) programs or Computer-Aided-Language-Learning (CALL) programs.

Although there are many advantages of using computer technology in the classroom, there are also disadvantages towards the application of such technology. Issues such as security, validity and reliability of the retrieved resources, legal implications across regional boundaries, obscenity, cost, and training should not be taken for granted. The cry for freedom of choice over the Internet activities is perhaps another issue that needs to be considered carefully. With so much legal and illegal activities on the Internet, business individuals are willing to put up all kinds of businesses that may not be appropriate for our children. Pornographic, digital motion video, live chat with women/men regarding sex and so forth are available alongside the good advantages of the Internet for education. Again, with little or no control over the capability of the Internet computer telecommunications, we are in conflict of whether to adopt or not to adopt the technology.
Problem Based Learning (PBL)

What is Problem Based Learning (PBL)?

The Problem Based Learning method is an educational model that focuses on the investigation and resolution of “ill-structured, messy, authentic real-world problems” (Illinois Mathematics & Science Academy, 1999). According to Jonassen (1997), ill-structured problems revolve around seeking “multiple solutions, solution paths, … and contain uncertainty about which concepts, rules, and principles are important for the [best fit] solutions” (p. 65). It is an active learning stimulated by, and focused around, a clinical, community or scientific problem (Davis & Harden, 1999). The nature of the ill-structured problem requires the learners to explore using inquiry and systematic investigation. The problem serves as the organizing center and context for the learning process. It starts with individual hooks, examples or problem scenarios that stimulate student’s learning. In so doing, students arrive at general principles and concepts that they can generalize to other real life situations.

Students are the stakeholders of both the problems as well as the resolutions. They are empowered through the PBL method because they can feel the relevance of seeking information and knowledge in the effort to solve the real-world problem. The authentic nature of the problem causes the students to be motivated to find the best solutions. Active engagement and participation are also required of PBL students. They assume active roles as investigators, problem-solvers and decision-makers (Barrows, 1998; IMSA, 1999). Students also develop self-directed learning skills, self-assessment and criticism of themselves. Through the learning process, the students become actively involved in the processing of information, and relate new problems to their prior knowledge; they elaborate and organize new knowledge meaningfully (Davis & Harden, 1999). Through a collaborative effort, students develop interpersonal and communication skills that enhance them to become more effective learners (Johnson & Johnson, 1990).

Teachers are facilitators, not information providers. Their responsibility is to facilitate and coach the students toward achieving the broader goals of the PBL. Teachers can also assume the role of co-investigators. This role is possible since the nature of the real-world problem is not structured as such that the teachers have all the answers. There are no simple fixed solutions and no right answers. Such an open-ended learning environment allows a healthy collaboration of student-student and students-teacher interactions (IMSA, 1999).

METHODOLOGY

Research Methods

This study was based on an experimental and a descriptive research design. The experimental research design followed a design called Randomized Solomon Four-Group Design (Fraenkel & Wallen, 1990). A descriptive research design using a survey instrument was administered in this study. Pretests and posttests based on a set of questionnaires seeking information regarding students’ attitude on the use of various Internet telecommunication tools for the purpose of collaborative and discussion activities with the online PBL model were also used.
Subjects

The samples of the study consisted of fifty-eight (58) undergraduate, non-declared graduate, Master’s and Doctoral students from the Department of Curriculum and Instruction at Southern Illinois University at Carbondale (SIUC) during the Spring and Summer 2000. The students were randomly grouped into 4 to 5 members. A group of twenty teachers who were following an instructional technology cohort master’s degree program with the Department also participated in the study. The breakdown of the experimental design is shown in Figure 1.

<table>
<thead>
<tr>
<th>Randomly Assigned</th>
<th>O1</th>
<th>Treatment</th>
<th>O2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>pretest</td>
<td>X</td>
<td>posttest</td>
</tr>
<tr>
<td>Experimental</td>
<td></td>
<td></td>
<td>posttest</td>
</tr>
<tr>
<td>Control</td>
<td>pretest</td>
<td></td>
<td>posttest</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td>posttest</td>
</tr>
</tbody>
</table>

Figure 1. Randomized Solomon Four-Group Design Used in the Study

Instrumentation

The instruments used in this study included the setting up of computer servers, the application of related software for web publishing and a research survey. An OS X Macintosh Server to host students’ web pages, and an audio chat room powered by the HearME technology were used for collaborative and discussion activities in support of the PBL model. A UNIX server was also utilized for hosting WebCT telecommunication tools and activities. A Macromedia Dreamweaver HTML editor, a Quicktime 4 Pro program, a Real Producer encoder, a SoundEdit 16 software, an Adobe Premiere digitizing software and other Internet-related software were also used in this research study. Students were required to publish their final on-line PBL projects in the form of Internet-based multimedia web page presentations.

Data for this study were collected using a set of questionnaire seeking information and responses on the respondents’ attitudes towards the technology and their collaborative learning activities. Frequently asked questions related to the variables understudied – attitudes, perceived skills and knowledge toward computers telecommunication activities and collaborative learning, were carefully studied and used in the formulation of the questionnaire. The survey was also pilot tested before it was administered to the research subjects.

Data Collection Procedures

Prior to the research study, both control and experimental subjects, had been exposed to the basic knowledge and skills on how to design, develop and publish Internet based multimedia web pages. Some Internet telecommunication tools such as email, audio and video conferencing, threaded discussion and chat room were also demonstrated, discussed and experienced before the students participated in the study. The students were also lectured on the PBL model. The entire process of exposing the students to the fundamental knowledge, skills and Internet experiences began the first week of class and continued until the eighth week.
While going through the on-line PBL activities, the experimental groups were required to record all collaborative and discussion activities on a weekly basis. The documentation of their collaborative and discussion activities was in the form of on-line web journals, threaded discussions, emails, and summaries of audio/video conferencing activities. Only the experimental groups were assisted with all the guidance, support and on-line, real-time assistance using WebCT telecommunication tools. The control groups were only required to submit written reflective thoughts on their collaborative and discussion activities.

**Treatment of Data**

All data gathered were treated confidentially. From the questionnaire, the demographic information, responses on students’ perceived knowledge and skills, the frequency of telecommunication activities engaged in, remote interaction and cooperation, and students’ attitudes were gathered, tabulated and analyzed using Microsoft Excel and SPSS statistical packages. Frequency charts, distribution tables, ANOVA, interactions between and within group memberships, multiple regression and other statistical analyses were used. Leitner 7-step hypothesis testing approach was applied throughout this research study.

**ANALYSIS OF DATA**

**Presentation of Results**

*Demographic Information and Computer Resources*

The demographic distribution of the subjects by their experimental or control groups, gender and status is presented in Table 1. From the total of 58 participants, equal number of subjects was randomly placed in two different groups – experimental and control. There were 20 males and 38 females altogether participated in the study. Data for the demographic information and computer resources derive from the posttest. In total, 8 (14%) undergraduate students, 24 (42%) graduate students, 3 (5%) teachers and 21 (36%) cohort teachers participated in the study. Two (3%) respondents indicated that they were both teachers and graduate students.

**Table 1**

Demographic Distributions of the Subjects Based on the Experimental and Control Groups, Gender and Educational Status

<table>
<thead>
<tr>
<th>Status</th>
<th>Experimental</th>
<th></th>
<th>Control</th>
<th></th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td>Males</td>
<td>Females</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undergraduates</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Graduates</td>
<td>3</td>
<td>8</td>
<td>8</td>
<td>5</td>
<td>24</td>
<td>42</td>
</tr>
<tr>
<td>Teachers</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Cohort Teachers</td>
<td>2</td>
<td>9</td>
<td>1</td>
<td>9</td>
<td>21</td>
<td>36</td>
</tr>
<tr>
<td>Teachers &amp;</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Graduates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (N=58)</td>
<td>9</td>
<td>20</td>
<td>11</td>
<td>18</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>16</td>
<td>34</td>
<td>19</td>
<td>31</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
Students' Attitudes

The following hypotheses were tested to determine if perceived knowledge and skills, number of hours spent on Internet telecommunication tools and remote interaction and cooperation used for collaborative and discussion activities in support of the on-line PBL model, help or hinder the students' attitudes toward Internet telecommunications.

A. Did the experimental groups show more positive attitudes toward using the telecommunication tools for collaborative and discussion activities than the control groups before and after the treatment?

1. Ho: $\mu_{\text{ExpConAttitudePost}} - \mu_{\text{ExpConAttitudePre}} = 0$
   Ha: $\mu_{\text{ExpConAttitudePost}} - \mu_{\text{ExpConAttitudePre}} \neq 0$

2. Ho: $\mu_{\text{ExpAttitudePost}} - \mu_{\text{ExpAttitudePre}} = 0$
   Ha: $\mu_{\text{ExpAttitudePost}} - \mu_{\text{ExpAttitudePre}} \neq 0$

3. Ho: $\mu_{\text{ConAttitudePost}} - \mu_{\text{ConAttitudePre}} = 0$
   Ha: $\mu_{\text{ConAttitudePost}} - \mu_{\text{ConAttitudePre}} \neq 0$

Paired-samples two-tailed $t$ tests comparing the means of the samples were used to analyze the hypotheses. The sample size of the experimental and control groups was 32. From the findings tabulated, there is a significant difference ($p < .05$) on attitudes toward computer telecommunications by both groups ($n=32$) when comparing between the posttest and the pretest. Since $p = .02$ is less than alpha = .05, the null hypothesis is rejected. Thus, there is evidence that there is a difference in the attitudes toward telecommunication tools used for collaborative and discussion activities by both groups before and after the treatment period. Further analysis conducted on pretest versus posttest for the experimental group students ($n=16$) reveals that there is a significant difference ($p < .05$) on attitudes toward computer telecommunications. Since $p = .045$ is less than alpha = .05, the null hypothesis is again rejected. Thus, there is evidence that there is a difference in the attitudes toward telecommunications for the experimental group. However, the analysis conducted on pretest versus posttest for the control group students ($n=16$) shows that there is no significant difference ($p > .05$) on attitudes toward computer telecommunications. Since $p = .23$ is more than alpha = .05, the null hypothesis fails to be rejected. Thus, there is no evidence that there is a difference in the attitudes toward telecommunications for the control group.
Table 2
The Differences in the Attitudes Shown by the Experimental and Control Groups on Telecommunication Tools Used Before and After the Treatment

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>M</th>
<th>SD</th>
<th>SEM</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATTITUDP – ATTITUDE</td>
<td>.40</td>
<td>.89</td>
<td>.16</td>
<td>.07</td>
<td>.31</td>
<td>2.50</td>
<td>31</td>
<td>.02*</td>
</tr>
<tr>
<td>(n=32)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATTITUDP – ATTITUDE</td>
<td>.59</td>
<td>.08</td>
<td>.27</td>
<td>1.50</td>
<td>1.17</td>
<td>2.19</td>
<td>15</td>
<td>.045*</td>
</tr>
<tr>
<td>(Exp. n=16)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATTITUDP – ATTITUDE</td>
<td>.20</td>
<td>.63</td>
<td>.16</td>
<td>-.14</td>
<td>.54</td>
<td>1.26</td>
<td>15</td>
<td>.23</td>
</tr>
<tr>
<td>(Con. n=16)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note.
* Significant at p < .05
** ATTITUDP: Attitudes toward telecommunications on Posttest
ATTITUD: Attitudes toward telecommunications on Pretest

4. ** Ho: \( \mu_{\text{Exp AttitudePost}} - \mu_{\text{Con AttitudePost}} = 0 \)
   Ha: \( \mu_{\text{Exp AttitudePost}} - \mu_{\text{Con AttitudePost}} \neq 0 \)

An independent-sample two-tailed \( t \) test comparing the means of the samples was used to analyze the above hypothesis. The sample size of the experimental and control groups was 32. From the findings tabulated, there is no significant difference (\( p > .05 \)) on attitudes toward computer telecommunications by both groups (n=32) during the posttest only. Since \( p = .31 \) is more than alpha = .05, the null hypothesis fails to be rejected. Thus, there is no evidence that there is a difference in the attitudes toward telecommunication tools used for collaborative and discussion activities by both groups after the treatment period.

Table 3
The Differences in the Attitudes Shown by the Experimental and Control Groups on Telecommunication Tools Used After the Treatment

<table>
<thead>
<tr>
<th>( t ) test for Equality of Means</th>
<th>Mean Diff</th>
<th>Std. Err Diff</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>** ATTITUDP</td>
<td>.21</td>
<td>.20</td>
<td>-.20</td>
<td>.61</td>
<td>1.03</td>
<td>30</td>
<td>.31</td>
</tr>
</tbody>
</table>

Note.
Experimental (Exp.) and Control (Con.) n=32
** ATTITUDP: Attitudes toward computer telecommunication tools by both groups - Posttest
Primary Hypothesis:

B. Did the perceived knowledge and skills, number of hours spent on Internet telecommunication tools used for collaborative and discussion activities, and remote interaction and cooperation predict the students' attitudes toward Internet telecommunications?

\[
\text{FM: } \hat{\text{Attitude}} = a + b_{1\text{KS}} + b_{3\text{KAsync}} + b_{2\text{FreqSync}} + b_{4\text{FreqAsync}} + b_{5\text{IntColl}}
\]

\[
\text{RM: } \hat{\text{Attitude}} = a
\]

Where:
- \(\text{FM} \) = Full Model
- \(\text{RM} \) = Restricted Model
- \(\hat{\text{Attitude}} \) = Attitudes hat (\(\Lambda\))
- \(\text{KS} \) = Knowledge and skills on synchronous tools
- \(\text{FreqSync} \) = number of hours spent on synchronous tools
- \(\text{KAsync} \) = Knowledge and skills on asynchronous tools
- \(\text{FreqAsync} \) = number of hours spent on asynchronous tools
- \(\text{IntColl} \) = Interaction and collaboration conducted remotely.

Secondary Hypothesis:

1. Did the perceived knowledge and skills on Internet tools used for discussion activities influence the students' attitudes towards Internet telecommunications holding the number of hours spent on telecommunication activities, and remote interaction and collaboration constant? (That is: \(\rho^2 \hat{\text{Attitude}} \text{KS} \text{KAsync} \text{FreqSync} \text{FreqAsync} \text{IntColl}\))

3. Did the number of hours spent on Internet tools used for discussion activities influence the students' attitudes toward Internet telecommunications holding knowledge and skill, and remote interaction and collaboration constant? (That is: \(\rho^2 \hat{\text{Attitude}} \text{FreqSync} \text{FreqAsync} \text{KS} \text{KAsync} \text{IntColl}\))

3. Did the remote interaction and collaboration used for discussion activities influence the students' attitudes toward Internet telecommunications holding knowledge and skill, and the number of hours spent on synchronous activities constant? (That is: \(\rho^2 \hat{\text{Attitude}} \text{IntColl} \text{FreqSync} \text{FreqAsync} \text{KS} \text{KAsync}\))

Where:
- \(\text{Attitudes} \) = were measured using 11 items related to students' perceived attitudes toward Internet telecommunication tools and discussion activities
- \(\text{Knowledge} \) = was measured using the operational definition of Non-User, Novice, Competent and Expert
- \(\text{Asynchronous} \) = was the number of hours spent using different telecommunication tools used for collaborative and discussion activities (pretest & posttest)
Synchronous = was the frequency of telecommunication tools used for collaborative and discussion activities (pretest & posttest)

IntColl = Groups' Interaction and Cooperative tasks performed while going through the collaborative and discussion activities in support of the PBL

Five variables were put into the model to see if they predicted the experimental group’s attitudes toward computer telecommunications. The variables were perceived knowledge and skills, number of hours spent on synchronous and asynchronous telecommunication tools, and remote interaction and collaboration. A linear regression model using a stepwise method was used to examine the hypothesis above. The F test for the significant of the Full Model over the Restricted Model provides an $F_{k, n-k-1}$ with 1 and 27 degrees of freedom.

Table 23
Analysis of Variance on the Variables Used to Predict Attitudes Toward Computer Telecommunications for the Experimental Group

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Regression</td>
<td>2.39</td>
<td>1</td>
<td>2.39</td>
<td>7.86</td>
<td>.01</td>
</tr>
<tr>
<td>Residual</td>
<td>8.22</td>
<td>27</td>
<td>.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10.62</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adj. R Square</th>
<th>Std. Err. of Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.48</td>
<td>.23</td>
<td>.20</td>
<td>.55</td>
</tr>
</tbody>
</table>

Note. Experimental (Exp.) n=29
a Predictors: (Constant), INTCOLL
b Dependent Variable: ATTITUDE

From the findings tabulated, the remote interaction and collaboration variable (INTCOLL) is found to be a significant predictor of attitudes toward computer telecommunications. The F value was computed at 7.86 ($p < .01$). The analysis also reported that $R^2$ Attitude (IntColl . KSync KAsync FreqSync FreqAsync) = .23. That is, the frequency of remote interaction and collaboration variable accounts for about 23% of the variance in the experimental group’s attitudes toward computer telecommunications. Since the other two variables did not predict the tested variable, the secondary hypotheses – 1. $\rho^{2}$ Attitude FreqSync . FreqAsync IntColl and 2. $\rho^{2}$ Attitude FreqAsync . FreqSync IntColl “ were rejected and dropped from the model.
DISCUSSION AND CONCLUSION

Discussion

Influence on Attitudes toward Internet Telecommunications

The research hypotheses tested the attitudes of the experimental and control groups toward Internet telecommunications. A pretest/posttest comparison using t test reveals that there is a significant difference (p < .02) on attitudes toward computer telecommunications for both the groups (n=32). When the analysis was conducted separately comparing the pretest and posttest, the experimental group (n=16) indicated significantly positive attitudes toward computer telecommunications (p < .045); however, the control group (n=16) reported otherwise (p > .23). The posttest analysis of the same variable shows no significant difference on attitude toward telecommunications on both the experimental and control groups (n=32).

These findings indicate that through the learning process and the various synchronous and asynchronous telecommunication activities exposed to both the groups, the subjects’ attitudes become more positive toward the computer telecommunications. The experimental group subjects showed significant attitudes toward telecommunication activities compared to the control group students. One of the reasons for this finding is due to the experimental group being constantly assisted and coached throughout the treatment period while the control group was neglected by the instructor and class assistants. Mitra (1998) stated that learners experienced a positive shift of attitudes after they had undergone a period of training. In another research project, McMahon et al. (1999) reported that students felt computer support and help from lab assistants and academic staff was inadequate and difficult to obtain. Most help was obtained from knowledgeable friends. Lack of assistance and support causes them to have negative attitudes and perceptions toward computer use (McMahon et al., 1999).

It is therefore crucial that prompt support and assistance be provided to the students if one is to nurture positive attitudes toward computer telecommunications. Peer mediation or support and group collaboration can be set up to ensure that students do not become unmotivated or intimidated toward using the technology for telecommunication purposes.

Conclusion

On-line telecommunication courses are becoming more and more prevalent in the educational mainstream. The Internet based educational trend signifies the starting point of a cultural change in schools, colleges and universities that formerly seemed bound by tradition. Whether we like to accept or deny the impact created by this technology, as educators we need to be prepared to educate our new generations with the kind of knowledge and skills that are worth pursuing.

With proper guidance, right attitudes and adequate access to the use of technology, students can be coached to use computers as the tools to explore the richness of global knowledge and new experience that will broaden their horizons. By way of constructivist learning theory, coupled with problem-solving skills, perhaps our students can learn better. Using computers as educational tools in our classrooms will further allow them to explore their new knowledge and apply problem-solving skills in more authentic learning environments.
REFERENCES


