

The Effects of Instant Messaging on Distance Learning Outcomes

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Abstract

This study examines the use of instant messaging (IM) for student-teacher communication in distance education (DE) courses. IM is a simple Internet communication tool that may reduce the sources of dissatisfaction cited by many DE students and improve their performance, perception of the amount of information learned, and satisfaction with a class. As a relatively synchronous communication tool, IM may reduce the DE student's sense of social isolation, mediate quality interactions with the instructor, reduce the DE student's perception of the dissimilarity between the DE course and the traditional course, and facilitate instructor immediacy behaviors. A quasi-experiment was conducted to investigate whether IM is associated with these improvements. The results suggest that DE students who use IM to communicate with their instructor performed better and perceived IM to be higher in social presence than those students who used only asynchronous communication tools such as email.

Keywords: Instant Messaging, Distance Education, performance, course satisfaction, social presence

1.0 Introduction

Distance Education (DE) is a growing alternative to classroom instruction. It allows access to higher education for those people who otherwise may not have been able to achieve a college degree. DE programs offer students a wide variety of degree options as well as freedom from time and space constraints.

For many participants, the appealing features of DE are offset by the perception of social isolation for the distance learner, particularly from their instructor. The computer-mediated communication (CMC) technologies used for communication in the DE class can enhance or reduce this perception of isolation. For example, most distance learners now use email and electronic forums, but there are other popular CMC technologies (i.e., IM) that have not been widely adopted or studied for DE. Instant messaging (IM) is a simple, text-based CMC tool that is integrated into many course management systems and may have some characteristics (i.e.; the social presence) needed to reduce the social isolation cited by many DE students. IM is studied in the context of DE because the nature of DE requires students in virtual classes to synthesize new, and often unclear, information through CMC technologies.

1.1 Instant Messaging

Instant messaging is a CMC tool that has been widely adopted by young Americans (Shiu and Lenhart, 2004, p 188). Forty-six percent of Internet users between the ages of 18 and 27 are using IM more than email (Shiu and Lenhart, 2004). In 2005, 65% percent of American teenage Internet users under the age of 18 prefer using IM over email (NetDay, 2005).

1.2 Distance Education

The Internet and the availability of new CMC technologies have sparked a renewed interest in DE in both corporate and academic settings. An increasing number of universities are offering DE classes (Schelin, 2001) as a means to manage the demands for increased enrollment without the cost associated with raising new buildings. Students of all age groups, ethnicities, degree levels, and geographies participate in DE classes annually (Mendenhall, 2007). Distant programs provide unprecedented access to education to the many students that would otherwise be unable to enroll in classes, from working adults who cannot fit traditional classroom schedules into work and family responsibilities, to the more traditional students that cannot fit a class into a busy academic schedule (Mendenhall, 2007).

Although DE students perform as well as traditional students, they withdraw from classes at a higher rate mainly because of dissatisfaction with the DE environment (Carnevale, 2000). The quality of the instructor-student interaction and the awareness that the instructor is available to the student are important factors in student learning and satisfaction. IM has characteristics that may enhance the DE experience because they may reduce the isolation felt when using other text-based CMC technologies.

This study investigates whether students perceive IM to be higher in social presence than in other CMC technologies used in DE; and if so, does IM positively affect the students' satisfaction and real and perceived quality of learning?

2.0 Literature Review

2.1 Instant Messaging

IM is commonly defined as a text-based computer-mediated communication (CMC) tool that allows users to be aware of others who are logged into the service and to exchange messages in near synchronicity over the Internet (Kuyath and Winter, 2006). When users are logged onto the service, they can see that others are also logged on (Foley, 2002). Those who are already logged onto the service are notified of this new arrival by an audio and visual message. The users can then exchange text messages in near synchronicity via the IM service (Nardi, et al., 2000).

2.2 Distance Education

Distance education is defined as: "The acquisition of knowledge and skills through mediated information and instruction, encompassing all technologies and other forms of learning at a distance" (United States Distance Learning Association, 2007). This definition implies that information may be transferred to students through a variety of media, including books, videos, the Internet, television, telephone, or video or audio conferencing. Heeger (2007) describes DE as "a process by which teaching transcends geography" (Heeger, 2007, p 5). Swan and Shih (2003) describe DE as being free from time and space, providing increased access to higher education (Swan and Shih, 2003).

Distance education classes range from the self-paced, independent-study class, to the fully interactive class with live video and audio between the instructor and the students. Many DE classes today are online classes that allow students to access, read, and study written material on a weekly or daily basis, take quizzes and submit assignments to be graded by a certain due date. Students typically work independently unless questions arise, and then they ask questions of the instructor or other students through email or discussion forums. We describe distance education as an online, asynchronous learning environment that may contain optional synchronous features when possible.

The most consistent findings in DE research indicate that DE students perform as well as or better than their traditional counterparts, but that DE students withdraw from classes at a higher rate than traditional students due to dissatisfaction with the DE environment (Carnevale, 2000).

Several reasons have been cited as the sources of dissatisfaction for DE students, all of which are related to the social presence of the media used for communication. They are: 1) the DE student's sense of social isolation, 2) the lack of quality interactions with the instructor, 3) the DE student's perception of the dissimilarity between the DE course and the traditional course, and 4) the instructor's immediacy behaviors (Cohen and Ellis, 2004).

2.3 Social Presence

Social presence has been defined as "the extent to which one feels the presence of a person with whom one is interacting" (Latchman and Latchman, 2000) and "the feeling one has that the other persons are involved in a communication exchange" (Carnevale, 2000, p 188). The degree of social presence is determined by the medium. The more cues available in the medium, the more attention paid to the other participants (Walther, 1995). Face-to-face communication is able to transmit verbal as well as non-verbal cues and is therefore the highest in social presence. Text-based CMC technologies, such as email and discussion forums, are unable to provide non-verbal and visual cues and are, as a result, lower in social presence (Daft, et al., 1987).

Text-based CMC is usually weak for conveying social presence (Sproull and Kiesler, 1986). This may not hold true for IM. The immediacy of a communication medium also plays a role in its social presence (Sproull and Kiesler, 1986). IM may be perceived as being higher in social presence than other forms of text-based CMC because it is nearly synchronous and thus, decrease the feeling of social isolation among students.

Critics have claimed that DE is less effective than traditional classroom learning (Richardson and Swan, 2003) because the lack of face-to-face interactions cause students to feel socially isolated. The sense of social isolation is a major contributor to lower student satisfaction (Swan, 2004). Rovai (2004) believes that limited face-to-face accessibility to instructors can result in student anxiety and frustration (Rovai, 2004) and other research suggests that the physical presence of the instructor is essential to the learning process. However, it is possible that the availability of the instructor and the quality of the interactions with the instructor are what is important, not physical presence (Richardson and Swan, 2003).

IM may be higher in social presence than other CMC media used in DE (Kuyath and Winter, 2006) because of the indication that other participants are present and available for correspondence increases the medium's social presence (Sproull and Kiesler, 1986). Instant messaging allows a participant to determine if his/her contact is logged into the service (Shiu and Lenhart, 2004). This feature of IM may increase its social presence as compared to other text-based CMC. A media's ability to provide students with a sense that the instructor is immediately available and focused on the conversation has been found to affect communication content, student satisfaction, and perceived learning (Swan and Shih, 2003). Thus, because of IM's near synchronicity, multiple cues, and personal focus, it will likely have a higher social presence than other forms of text-based CMC and could therefore, reduce the dissatisfactions with DE.

2.4 Quality Interactions between Student and Instructor

Carnevale (2000) argues that DE students expect an instructor to interact regularly with their DE students just as they would in a traditional class (Carnevale, 2000). However, the greatest challenge facing online DE is providing quality interactions between faculty and students (Fein and Logan, 2003) which is important to student success and satisfaction. The quality of the interactions with the instructor has been found to be the most significant contributor to the student's success in DE courses (Fredericksen, et al., 2000), and was rated as one of the two highest online-course quality indicators by students enrolled in DE courses (Cohen and Ellis, 2004).

When faculty do not provide prompt and clear feedback students become frustrated and anxious (Hara and Kling, 2001). Frequent student-faculty interactions and prompt instructor feedback were found to be the most important factors in student motivation and involvement (Chickering and Gamson, 1987). Students who report high levels of interaction with their instructors also report higher levels of learning (Shea, et al., 2005).

In their meta-analysis of DE and IT communication tools, Lou et al. (2006) emphasize the importance of instructor-student and student-student interactions in DE and indicate that current technologies may not yet provide the high interactivity that a face-to-face setting affords. However, Lou et al. (2006) did not include IM in their study. IM has the potential to mediate focused discussions with prompt feedback between faculty and students, so it would seem to have potential for quality instructor interaction within distance learning contexts (Burnett, 2003) and thereby improve student satisfaction and perceived learning.

2.5 Dissimilarity between Distance Education and Traditional Classes

The most obvious difference between DE and traditional classes is that DE does not include face-to-face instructor-student interactions (Richardson and Swan, 2003). However, it is not clear if face-to-face interaction is necessary or if the quality and frequency of interaction is most important (Richardson and Swan, 2003). Spencer and Hiltz (2002) argue that asynchronous online distance education classes may fail to include some of the most important features of the traditional face-to-face class and that asynchronous online distance education classes provide even fewer of these features since they lack a quick feedback environment to resolve ambiguities and unforeseen student needs (Spencer and Hiltz, 2002). Although this may be true for a purely asynchronous online class, faculty that develops DE courses could provide the IT communication features that would be most helpful to students, whether they are synchronous or asynchronous. Shea et al. (2005) agree, saying “all paradigms of effective online teaching in higher education assert or imply that good online professors facilitate high levels of interaction with and between students” (Shea, et al., 2005, p 3).

Nicholson suggests that faculty could use IM for instructor-student interactions (Nicholson, 2002). Prompt feedback and frequent instructor-student interactions are the most important factors in student motivation and involvement (Chickering and Gamson, 1987). Prompt feedback and instructor immediacy behaviors were both positively associated with student satisfaction with the course (Arbaugh, 2001) and Picciano found that quality interaction was critical to faculty satisfaction (Picciano, 2002). It could be that the dissimilarities between distance education and traditional classes are less important than quality and timely interactions between faculty and students.

2.6 Instructor Immediacy Behaviors

“Immediacy refers to verbal and nonverbal communication behaviors that reduce social and psychological distance between people” (Arbaugh, 2001, p 43). Although this definition refers to immediacy behaviors in traditional face-to-face classes, Arbaugh argues that several immediacy behaviors may be used in DE classes to reduce the social and psychological distance between faculty and students; namely, using humor, addressing students by name, inviting questions, and providing prompt feedback (Arbaugh, 2001). IM can facilitate instructor immediacy behaviors.

For many DE students the most frustrating characteristic of online classes is the delay in responses from the instructor or other students (Rourke, et al., 2001). However, the instructor’s use of highly immediate behaviors has been associated with positive changes in students’ attitudes that contribute to their success, including an elevated motivation to study and a perception that more was learned in the course (Richardson and Swan, 2003; Swan, 2002). Timely and specific feedback also provides guidance to learners so that performance may be improved (Fein and Logan, 2003). McGreal and Elliot (2004) argue that IM is not yet used as a teaching tool and that its strength lies in its ability to facilitate immediate contact between students and teachers (McGreal and Elliott, 2004).

3.0 Research Questions and Hypotheses

IM is a simple and relatively new IT tool that is already commonly used by students, and may be effective for instructor-student interactions. IM may reduce the DE student’s sense of social isolation, mediate quality interactions with the instructor, reduce the DE student’s perception of the dissimilarity between the DE course and the traditional course, and facilitate instructor immediacy behaviors. Thus, IM could alleviate some of the dissatisfaction DE students experience and improve their perception of the amount of information learned in the class (Richardson and Swan, 2003; Swan, 2002).

This literature review leads to the following research questions: Is academic performance affected by the CMC technology used in DE. Specifically, does the academic performance of DE students improve when IM rather than email is used for student-instructor communication? Do DE students perceive IM to be higher in social presence than asynchronous CMC tools (email, discussion boards, postings, etc.)? If IM is higher in social presence, are DE students more satisfied with the course and do they perceive that they have learned more when IM is the CMC technology used for student-instructor communicate rather than asynchronous text-based media (i.e., email)?

Hypothesis 1: Distant learners who use IM as a medium for communication with their instructor will experience a better improvement in academic performance than distant learners who use only email.

Hypothesis 2: Distant learners will perceive IM to be higher in social presence than email.

Hypothesis 3: Distant learners who use IM as a medium for communication with their instructor will perceive that more was learned than distant learners who use only email.

Hypothesis 4: Distant learners who use IM as a medium for communication with their instructor will be more satisfied with the course than distant learners who use only email.

4.0 Research Design

The first author, a professor of engineering technology, conducted a quasi-experiment to test the hypotheses. Participants were recruited from DE students enrolled in several junior and senior level, engineering technology classes offered at a large public university in the Southeastern U.S. during the fall semester of 2007. The topics in these classes are of sufficient depth and complexity to test the effectiveness of IM under realistic circumstances. The quasi-experiment was conducted during the seventh and eighth week of a sixteen-week semester to ensure that the topics were of sufficient difficulty to warrant the use of CMC for high level, complicated, and equivocal communication.

The quasi-experiment was designed as a Switching-Replications Quasi-Experiment (Trochim, 2001, p231), a type of Non-Equivalent Group Design (NEGD). A switching replications design is a common design for a classroom setting in which grades may be affected. In the switching replications design all participants eventually receive the treatment, avoiding any ethical issues associated with the differential application of treatments that may affect classroom performance (Trochim, 2001). It is possible that the students would perceive the use of IM to be an advantageous treatment and that it would improve the performance of those students who used it, so it was important to allow all students access to the treatment.

All data were collected electronically, through a web-based questionnaire, and downloaded to the Statistical Package for the Social Sciences (SPSS, version 12) for analysis.

4.1 Participants

Participants were recruited from several junior and senior level, fall semester engineering technology classes. In the targeted classes, 74 students were enrolled. With the small number of potential participants and very few women and underrepresented minority students enrolled in the classes, random assignment to treatment groups was unlikely to result in groups that were equivalent on important characteristics related to performance and satisfaction (i.e. age, gender, ethnicity, GPA, and current class average). Therefore, participants were assigned to one of two equivalent groups (see Table 1). Of the 74 students enrolled in the targeted classes, 60 agreed to participate in the study. As the study progressed, one participant dropped out, leaving 59 participants. Participants ranged in age from 20 to 51. Students' GPAs ranged from 1.0 to 4.0 on a 4-point scale.

Table 1: Group Demographics

	<i>Red Group</i>	<i>Blue Group</i>
<i>Female</i>	<i>1</i>	<i>1</i>
<i>Male</i>	<i>28</i>	<i>29</i>
<i>Mean Age</i>	<i>27</i>	<i>27</i>
<i>Mean GPA</i>	<i>3.0</i>	<i>2.9</i>
<i>Number White</i>	<i>18</i>	<i>19</i>
<i>Number African American</i>	<i>6</i>	<i>7</i>
<i>Number Asian American</i>	<i>1</i>	<i>1</i>
<i>Number Hispanic</i>	<i>1</i>	<i>0</i>
<i>Number Other</i>	<i>3</i>	<i>3</i>

4.2 Measures

Several indicators of social presence, course satisfaction and perceived learning were taken from previous research (Lightfoot, 2006; Richardson and Swan, 2003; Rodriguez, et al., 1996; Serva and Fuller, 1999; van Baren and IJsselsteijn, 2004). The measured indicators were factor analyzed using a confirmatory factor analysis with varimax rotation to verify the convergent and discriminant validity of the three constructs. Table 2 illustrates the results.

The three factors that emerged from the factor analysis converged on the expected constructs and explained 79% of the total variance. This was expected because these constructs were adapted from previous research studies on social presence (Richardson and Swan, 2003; van Baren and IJsselsteijn, 2004), perceived learning (Richardson and Swan, 2003), and student satisfaction (Richardson and Swan, 2003; Serva and Fuller, 1999).

Table 2: Results of Factor Analysis

Items/Constructs	Social Presence	Perceived Learning	Course Satisfaction
Personal	.924		
Immediate	.866		
Interactive	.852		
Sociable	.809		
Warm	.722		
Course Satisfaction			.882
Course Met Expectations			.863
Instructor Response			.838
Quantity of Interactions			.722
Quality of Interactions			.867
Topic Confidence		.890	
Topic Knowledge		.833	
Good Grade on Topic		.787	
Learned a Lot		.723	
Help a Friend with Topic		.667	

To measure academic performance, students submitted an academic assignment at each observation point in the quasi-experiment (pre-test, post-test 1, and post-test 2). Each assignment covered the same information, but had different problems. For example, one of the targeted classes for the study was a digital design class. Students reduced 20 logic expressions to their simplest form through Boolean algebra and Karnaugh Maps. For the pre-test and during each treatment session, students were given a different set of new, but equally difficult set of Boolean expressions to be simplified in the same way. During the treatment sessions of the study, students were allowed to ask questions about the problems as they completed the assignment, but they were required to use the CMC technology assigned to their group for this treatment session (see Figure 1). The grades on the assignment were used to assess the students’ academic performance (hypothesis 1).

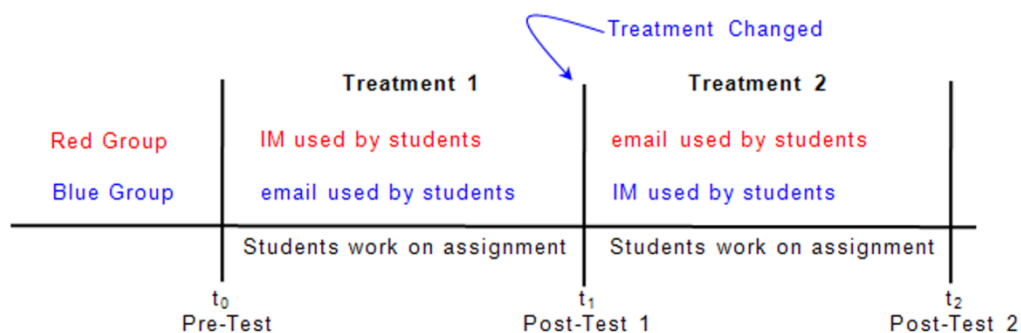


Figure 1: Timeline for Quasi-Experiment and CMC used

5.0 Procedure

5.1 Pre-Test

At time t_0 (see Figure 1), all participants were asked to respond to the questions on an initial questionnaire about their perception of the social presence of the communication medium used during the first treatment, perception of the amount learned in the class to this point in time, and their satisfaction with the course. Students submitted the original class assignment at this time also. There were two main reasons for acquiring this data: 1) it established a baseline for the students’ understanding of the subject matter prior to the treatment and 2) it provided a set of data to be used as covariates for an experiment of this kind. This will be explained in more detail in the analysis section.

5.2 Treatment 1

Participants were given a second assignment on the same course topic at the beginning of treatment 1. The Red Group (initial treatment group) used IM to ask the instructor questions as they worked on the new assignment. It was planned that if the number of students participating in an IM session became too large, the participants would be invited into a chat room so that they could all communicate synchronously and simultaneously. The Blue Group (initial control group) was only allowed to ask questions via email.

Times that the instructor promised to be logged into the IM service were posted for the students of the Red Group prior to the treatment (virtual office hours). The virtual office hours were at times that students would most likely be working on their assignment; i.e. evenings and weekends. The instructor was also available at unscheduled times in which the students in the treatment group could ask questions if they were logged onto the IM service and saw that the instructor was available.

5.3 Observation 2

The participants were asked to respond to questions about the participants' perception of the social presence of the medium used during treatment 1, of the amount of information learned in the class at this point in time, and satisfaction with the course at this point in time. The participants also submitted the second assignment at this time.

5.4 Treatment 2

Following the second observation the treatment applied to each group was switched and the third assignment was provided. As shown in figure 1, the Red Group (the initial treatment group) was now the control group, i.e., they used email. The Blue Group (the initial control group) was now the treatment group, i.e., they used IM. During treatment 2, the participants started working on the assignments for the 3rd time (different, but equally difficult questions) and each group was allowed to ask the instructor question using the assigned CMC technology.

5.5 Observation 3

At the third observation point, the participants submitted the third assignment and responded to the questionnaire for the final time.

6.0 Results

6.1 Analysis

Analyses of covariance (ANCOVA) were used to test the hypotheses. The control and treatment groups were the grouping variables and the dependent variables were academic performance (grades on the 3 assignments), the perceived social presence of the medium used, perceived learning and course satisfaction.

Although every effort was made to maximize the similarity of the groups, there were differences between the groups that were unaccounted for due to the non-random opportunity sampling used in this study. Therefore, any significant pre-test treatment differences found between the two groups could be due to the unaccounted for unobserved variables and not the treatment.

Pre-test measurement error is also unavoidable in an NEGD design, but the measurement error can be estimated and statistically minimized. Reliability is directly related to measurement error and was used to estimate the measurement error (Trochim, 2001). Cronbach's alpha was used as the reliability score for each pre-test measure (Trochim, 2001).

$$(Eq. 1) \quad X_{adj} = \bar{X} + \alpha(X - \bar{X})$$

Due to the non-random sampling of the NEGD design the pre-test scores were used as covariates in the ANCOVA analysis. The pre-test scores were adjusted using equation 1 to control for as much pre-test measurement error as possible and then aggregated to form a single measure for each of the measures. The adjusted pre-test scores were then used as covariates in the post-test analyses to control for the non-equivalency of the two groups (Cook and Campbell, 1979).

7.0 Hypothesis Testing

7.1 Academic Performance

If IM is a more effective CMC technology, then ET distance learners who use IM to ask questions of their instructor would perform better academically than the students who use only email because the students using IM would gain a better understanding of the information than the students using email. An assignment was given to students to measure their academic performance.

7.2 Pre-Test Analysis

The pre-test scores were analyzed with ANCOVA. The scores were tested to determine if there was a significant difference between the groups prior to treatment. As shown in table 3, the two groups had almost the same means at the time of the pre-test (the baseline data), suggesting that both groups were similar in academic performance and understood the course topic almost equally well.

Table 3: ANCOVA Results for Academic Performance

<i>Pre-Test</i>					
<i>Group</i>	<i>No. of Students</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>F</i>	<i>p</i>
<i>Red Group</i>	29	59.65	23.77	.018	.894
<i>Blue Group</i>	30	60.53	26.62		
<i>Post-Test 1</i>					
<i>Group</i>	<i>No. of Students</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>F</i>	<i>p</i>
<i>Red Group (IM)</i>	29	86.17	15.42	23.792**	.000
<i>Blue Group (email)</i>	30	68.13	26.28	*	
<i>Post-Test 2</i>					
<i>Group</i>	<i>No. of Students</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>F</i>	<i>p</i>
<i>Red Group (email)</i>	29	94.86	6.45	1.143	.290
<i>Blue Group (IM)</i>	30	91.93	18.15		

*** *F* is significant at the .001 level

7.3 Post-Test 1 Analysis

The post-test 1 (t_1 , see figure 1) scores were analyzed using ANCOVA. The student's GPA and the pre-test scores were used as the covariates. The results are shown in table 3.

The scores from the first post-test were measured immediately after the first treatment (t_1). Both groups improved their scores, but the red group, the group that used IM to ask questions gained approximately 26 points, while the blue group, the group that used only email to ask questions gained 8 points. The group that used IM to communicate with their instructor scored significantly higher than the group that only used email ($F = 23.792$, $p < .001$). These results support hypothesis 1 and indicate that ET distant learners who use IM to communicate with their instructor perform better academically than those ET students that use email to communicate with their instructor.

7.4 Post-Test 2 Analysis

The final performance measure was taken at post-test 2. At this time both groups had used IM. The blue group was the group that used IM (treatment group) during the second treatment period. The red group (control group) used only email during this period. The ANCOVA results are also shown in table 3.

Table 3 shows that both groups scored higher in post-test 2 than they did in post-test 1. The blue group (the group now using IM) gained more points as compared to the previous assessment (24 points), while the red group (the group now using email) only gained 8 points. Although both group scored higher now that all students had the opportunity to use IM to communicate with the instructor, the difference in scores was insignificant ($F = 1.143$, ns).

7.5 Social Presence

ANCOVA was used to test the difference between the two groups' perception of social presence in the communication medium used to communicate with their instructor during each treatment period. The adjusted and aggregated pre-test scores for social presence were used as the covariate in the reliability-corrected ANCOVA model (Trochim, 2001).

During the first treatment, the red group (initial treatment group) used IM. The blue group (the initial control group) used email. The results shown in table 4 support hypothesis 2 and indicate that ET distance learners perceived IM to be significantly higher in social presence than email ($F = 7.012$, $p < .01$).

Table 4: ANCOVA Results for Social Presence

<i>Post-Test 1</i>					
<i>Group</i>	<i>No. of Students</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>F</i>	<i>p</i>
<i>Red Group (IM)</i>	29	5.78	.923	7.012**	.010
<i>Blue Group (email)</i>	30	4.87	.864		
<i>Post-Test 2</i>					
<i>Group</i>	<i>No. of Students</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>F</i>	<i>p</i>
<i>Red Group (email)</i>	29	4.96	1.141	13.343**	.001
<i>Blue Group (IM)</i>	30	5.94	.749	*	

** *F is significant at the .01 level*

*** *F is significant at the .001 level*

The social presence measure was taken a second time following the second treatment period. During the second treatment period, the blue group used IM and the red group used email. These scores represent the participants' perceptions after the treatments had been switched and the experiment was run a second time. As before, the adjusted and aggregated pre-test scores were used as the covariate in the reliability-corrected ANCOVA model (Trochim, 2001). The results are shown in table 4.

These results also support hypothesis 2 and suggest that ET distance learners perceived IM to be significantly higher in social presence than email ($F = 13.343$, $p < .001$).

7.6 Perceived Learning

The pre-test scores for Perceived Learning were adjusted and used as the covariate in the reliability-corrected ANCOVA model (Trochim, 2001). The results are shown in table 5.

Table 5: ANCOVA Results for Perceived Learning

<i>Post-Test 1</i>					
<i>Group</i>	<i>No. of Students</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>F</i>	<i>p</i>
<i>Red Group (IM)</i>	29	5.83	.661	0.452	.504
<i>Blue Group (email)</i>	30	5.74	.946		
<i>Post-Test 2</i>					
<i>Group</i>	<i>No. of Students</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>F</i>	<i>p</i>
<i>Red Group (email)</i>	29	6.297	.567	0.017	.895
<i>Blue Group (IM)</i>	30	6.287	.545		

There was no significant difference between the IM group's scores (5.83) and the email group's scores (5.74) at post-test 1 ($F = .452$ ns) or at post-test 2 ($F = .017$ ns). These results do not support hypothesis 3. The results suggest that the distance learners' perception of how much was learned was unaffected by the CMC used during the treatment period.

7.7 Course Satisfaction: Hypothesis 4

The pre-test scores for course satisfaction were adjusted and used as the covariate in the reliability-corrected ANCOVA model for course satisfaction (Trochim, 2001). The results are shown in table 6.

Table 6: ANCOVA Results for Social Presence

<i>Post-Test 1</i>					
<i>Group</i>	<i>No. of Students</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>F</i>	<i>p</i>
<i>Red Group (IM)</i>	29	6.01	.788	.265	.609
<i>Blue Group (email)</i>	30	5.89	.798		
<i>Post-Test 2</i>					
<i>Group</i>	<i>No. of Students</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>F</i>	<i>p</i>
<i>Red Group (email)</i>	29	6.172	.6475	1.780	.187
<i>Blue Group (IM)</i>	30	6.373	.5723		

These results do not support hypothesis 4 because there was no significant difference between the IM group's scores (6.01) and the email group's scores (5.89) at post-test 1 ($F = .265$ ns) or at post-test 2 ($F = 1.78$ ns). These results do not support hypothesis 4 and indicate that student's satisfaction with the course was unaffected by the CMC used during the treatment period.

8.0 Discussion

This study tested academic performance, social presence, perceived learning, and course satisfaction of DE students who used IM rather than email to communicate and ask questions of their instructor. If IM was higher in social presence than email, it was hypothesized that the DE students that used IM rather than email would perform better, have a higher sense of perceived learning and a higher satisfaction with the course. A quasi-experiment was conducted to test these hypotheses.

The first two hypotheses were supported: Distance learners who use IM to interact with their instructor performed better than distant students that use only email to communicate with their instructor (hypothesis 1) and DE students perceived instant messaging to be higher is social presence than email (hypothesis 2). The characteristics of IM helped reduce the sources of dissatisfaction for the distant students so that they felt less isolated. These same characteristics of IM allowed the instructor to respond to questions in a more timely manner.

This improved the quality of the interactions with the instructor and may have reduced some of the perceived differences between the DE course and the traditional course.

The most important finding in this study was that the ET distance learners performed significantly better when they used IM to communicate with their instructor than when they used only email. This suggests that the ET distance learners understood the course material and the instructor's explanations better when they used IM to communicate with their instructor than when the students used only email. This finding also suggests that IM is more effective in communicating complex and difficult information and could be used in many other applications to improve communications.

We also tested to see if there was a significant improvement in academic performance for DE students who used IM rather than email to communicate with their instructor. To test this, each group's mean scores were compared to their means at the previous observation point. The improvement in mean scores for the red group (the initial treatment group) was significant between the pre-test (59) and the first post-test (86) ($F = 25.405$, $p < .001$): the period in which this group was using IM to communicate with their instructor. The improvement between post-test 1 (86) and post-test 2 (94) was also significant, but much less than the improvement when using IM ($F = 7.839$, $p < .05$).

The improvement in mean scores for the blue group (the group using email) was insignificant between the pre-test (60) and the first post-test (68) ($F = 1.237$ ns). However, the improvement between post-test 1 (68) and post-test 2 (91), the period in which this group used IM, was significant ($F = 16.660$, $p < .001$).

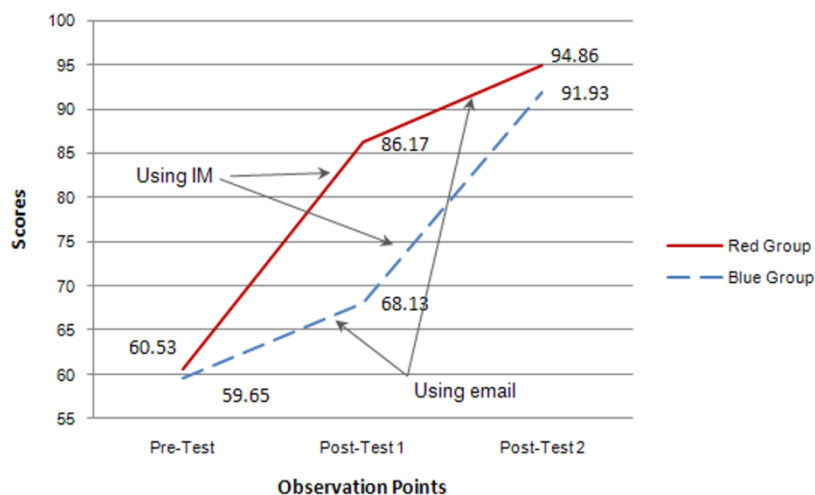


Figure 2: Comparison between Groups at Observation Points

Figure 2 plots the scores for each group from pre-test to post-test 1 to post-test 2. This graph shows the significant improvement as each group used IM and the lesser improvement made when the groups used email. These results also support hypothesis 1: that ET distant learners who use IM to communicate with their instructor perform better academically than the distant learners who use only email to communicate with their instructor.

Hypotheses 3 and 4 were not supported: there was no significant difference between the IM group and the email group when the participants rated perceived learning and course satisfaction. However, there was a significant improvement in both of these constructs during the two-week period of the experiment. Typically a student's perception of the amount learned or satisfaction with a course would not improve very much in such a short period of time. Perhaps the increased interaction with the instructor and the quality of the interactions with the instructor, whether with IM or email, improved the students' overall perception of the quality of learning and course satisfaction.

Course satisfaction and perceived learning were also highly correlated with social presence: $r = .44$ ($p < .01$, $r^2 = .19$) indicating that the higher the social presence perceived, the higher the course satisfaction and perceived learning.

With IM perceived as higher in social presence than email, it follows that students will also be more satisfied with the course and feel that they learned more, although it may not be possible to discern the differences between groups in a two-week period. If the experiment were conducted differently (e.g.; one class using IM for a whole semester and another class or the same class the following semester using email for the whole semester) the difference in course satisfaction and perceived learning between groups may be more discernible.

9.0 Conclusion

This study shows that IM can be a more effective CMC technology for conveying complex and difficult to understand information than email or other forms of text-based CMC. Research has found that DE students perform as well as traditional students, but they withdraw from classes at a higher rate because of dissatisfaction with the DE environment. There are several sources of dissatisfaction, but all are related to the social presence of the CMC technologies used in the DE environment. Because the social presence of IM was determined to be higher than email the students who used IM performed better than their counterparts who only used email.

The quality of the instructor-student interaction and the awareness that the instructor is available to the student are important factors in student learning. Instant messaging has characteristics that improved the quality of the interactions and enhanced the distant learning experience for these students. Several students stated that they liked using IM to ask questions because it allowed for the quick feedback they needed at the time and it allowed them to ask additional questions. Students also indicated that they liked the fact that they could see that the instructor was available through IM whether they wanted to ask questions or not.

These are important findings for the IS and IT community. For the IS community, this study adds to the body of knowledge of how new technologies are used and their effectiveness. For the IT community, this study adds to the body of knowledge of the design and implementation of computer mediated communication media that could improve the media's effectiveness. This knowledge could help programmers develop more effective CMC technologies.

This study also advances the field of distance education in that it shows advantages to using synchronous CMC technologies, although it is not clear that the results would be the same if IM is used in other disciplines and other instructors. There is a place in DE for email and discussion boards, especially when students are required to reflect on the discussion before they provide input. This study shows that when questions arise and students need immediate answers to their questions, faculty should consider using IM.

10.0 Limitations

There were several limitations to this study. The first is that the study may have been too short to discern subtle differences in class satisfaction and perceived learning. Perhaps a study that had a longer duration i.e., a semester or more would be able to do so. There was a small number of students available to participate in this study. Only one faculty member conducted the experiment so that confounding factors, such as instructor communication practices, charisma, difficulty of the class, etc., did not come into play. Still, a larger study, with more participants and in other disciplines would be valuable.

The first author did find, on occasion, that he had to reply to emails more quickly than he would under normal circumstances because students could see that he was logged into the computer (via IM) even if they were not using IM for that phase of the study. The increased interaction with students could partially explain the improvement in perceived learning and course satisfaction over the two weeks of the experiment.

Using IM as a regular part of a DE class may be impractical because of the many and varied tasks required of university faculty. The amount of time needed to sufficiently answer the students' questions is prohibitive. Also, the constant interruptions would make using IM difficult unless that was the only reason the faculty member had logged into the service.

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