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Full Length Research Paper

An examination of university students' views on computer-mediated instruction/learning and its impact on their academic achievement

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This study provides insight into how participants' demographic profiles contributed to their perceptions of computer-mediated learning, how students perceived the impact of computer-mediated learning on their achievement, and how having had to use computers impacted their attitude toward (future) learning using computer technology. A descriptive and correlational research design was used for this study. Participants were 112 students in a science and technology university in Southern Taiwan. A 25-item self-reported questionnaire was administered to the students and the data was analyzed quantitatively using SPSS software. The findings of the study include: (a) a T-test that revealed a statistically significant difference between male and female students, for the statement: "I think effective Computer-Mediated Learning ensures that students are engaged and motivated in learning (the given subject)." Female students' mean score was higher than that of male students; (b) an ANOVA test found statistical significant differences among groups of students based on their grade point average (GPA) and their perceived effectiveness of computer-mediated learning. A Tukey HSD test indicated the GPA group 3.50 to 4.00 obtained a higher mean score than the other two groups, 2.00 to 2.49 and 2.50 to 2.99; (c) a Pearson Product-Moment Correlation analysis revealed a statistically significant, low positive association between students' perceived effectiveness in the area of computer-mediated learning and their grade point average (GPA). It also revealed a statistically significant, moderate positive association between having to use computers for class(es) in students' major program areas and their attitude toward learning using computer technology. It is recommended that future researchers conduct qualitative studies in the area of computer facilitated language learning or add an interview component to their studies to aid investigation. Future studies might seek teachers' and/or administrators' perceptions and attitude of computer-mediated instruction/learning so that comparisons can be made to students' perceptions.

Key words: Computer-mediated instruction, computer-mediated learning, computer technology instruction/ learning.

INTRODUCTION

Computer mediated instruction/learning is an umbrella term (Strange and Banning, 2001, p. 184) that describes the efficient and effective use of computer and/or technology to support and facilitate teaching and learning activities (Bull et al., 1998). "The traditional classroom paradigm is being challenged today, not so much by professors who have by and large optimized their teaching efforts and their time commitments to a lecture format, but by our students" (Duderstadt et al., 2002, p.

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61).

Higher education has experienced notable changes driven by accelerated advances in computer technology, the same force that has reshaped our society and many aspects of life. Such changes include a very heavy dependence on schools' management and administration systems. In terms of teaching and scholarship, it is believed by many that more promising results can be seen and that students are better served in a computer-mediated learning environment (Duderstadt et al., 2002, p. 7) due to the computer's seemingly infinite ability to multiply and expand, to simulate physical phenomena, to create virtual experiences and an opening learning environment made possible by powerful information networks.

Many scholars believe that more promising results can be seen due to the computer's seemingly infinite ability to multiply and expand in terms of its ability to carry out multiple tasks simultaneously and process large volumes of data, (Brode, 2005; Grementieri, 1998; Hiemstra and Poley, 2007). However, not everyone shares the same optimism about the introduction of computer technology into the academic area. In mid-1980s, when college faculty members and administrators were hyped about adding new computing to campuses, Gilbert and Green (1986) pointed out that purchasing and integrating computer technology can raise complicated issues at the core of academic life, and these issues involve considerable costs. For many school managers and administrators, allocating a large sum of capital from limited resources is indeed a big gamble. One misstep in decision making can mean catastrophic damage to the organization.

The Higher Education Research Institute (HERI) at the University of California in Los Angeles published the findings of its triennial surveys of teaching methods, which were sent to 71,000 professors of undergraduate instruction in over 500 private and public colleges and universities. Based on a 42% return rate, equivalent to close to 30,000 responses, the report revealed that in academic year 1998 to 1999, 53% of the respondents said they used "Extensive Lecturing" as primary instructional method in most or all undergraduate courses, it went down 2% from 55% in the 1995 to 1996 academic year. Only 17% responded that they used "Computer/Machine-added Instruction" in most or all undergraduate course, up from 14% in three years. This percentage growth is relatively small compared to the 35% increase of the total projected computer technology expenditure in postsecondary schools during the same time span (Cuban, 2001). Zemsky and Massy (2004), in their "Thwarted Innovation," contested that corporations are pushing too many products to the educational settings that fail to deliver as much value as promised. Educators agree that the effective use of computer technology in the facilitation of successful teaching and learning is a common goal.

A wealth of research related to computers and instruction exists focusing on the merits of computer technology tied to our modern society (Senese, 1983, 1984; Strover and Bryant, 1983) and the technological revolution coming to our classrooms (Brode, 2005; Grementieri, 1998; Kozma and Johnston, 1991). There is also an enormous amount of research addressing the trends and issues surrounding the application of multimedia such as degree of interactivity, hardware performance and development, accessibility and dependability, maintenance and costs (Spicer and Stratford, 2001; Vogel and Klassen, 2001; Yu et al., 2008). However, there seems to be limited research investigating students' perceptions of the teacher's pedagogical choice to use computer-mediated instruction/learning and its impact on students' academic achievement.

Purpose of the study

This study was designed to provide insight into how students' demographic profiles, for instance, age, gender, grade point average (GPA), area(s) of concentration, class rank, occupation, and experience of using computers for learning, contribute to their perceptions of computer-mediated learning, how their perceived effectiveness of computer-mediated learning impacted their academic achievement, and how having had to use computers impacted their attitude toward (future) learning using computer technology.

Research questions

The researchers sought answers to these questions:

1. Are there any significant differences in students' perceived effectiveness of computer-mediated learning based on their demographics?
2. Are there any meaningful relationships between students' perceived effectiveness of computer-mediated learning and grade point average (GPA)?
3. Are there any meaningful relationships between having to use computers for the class(es) in students' major program areas and students' attitude toward learning using computer technology?

METHODOLOGY

Research design

The research design for this study was a combination of descriptive and correlational research. In this study the inter-relationships between the variables such as students' perceived effectiveness of computer-mediated learning, demographics, achievement, and students' attitudes toward (future) learning using computer technology were sought.

Participants

The data was collected from student participants from four randomly selected classes out of ten sections of Computer Applications in Education at a Southern Taiwan University of Science and Technology. The researcher visited each selected class and asked all students for their voluntary participation. Those who agreed to participate were the population for the study. The participants varied in their areas of concentration (majors) and were at different stages of their degree, as far as their class rank is concerned (freshman, sophomore, junior, senior, graduate, or non-degree). A total of 129 students were enrolled in the selected sections and 112 students participated in the study, resulting in a participation rate of 87%.

Instrumentation

The questionnaire was designed to collect demographic information about the participants, to evaluate participants' perceptions of computer-mediated instruction/learning, and to collect a variety of information related to participants' program area, involving a 25-item questionnaire (Appendix A) that was made up of a number of sections:

Section A – Questions 1 to 7 included a mix of multiple-choice and open-ended questions. Participants were asked to specify demographic variables such as gender, age, major (area of concentration), class rank, grade point average (GPA), participant's current occupation, and their experience in computer use for learning.

Sections B through D – Questions 8 through 25, were in five-point Likert scale format, with number 1 being Strongly Disagree (SD) , number 2 being Disagree (D), number 3 being Agree (A), number 4 being Strongly Agree (SA), and Not Applicable (NA).

Questions 8 to 13 in Section B measured the students' perceived effectiveness of Computer-Mediated Instruction/Learning. Questions 14 to 16 in Section C dealt with the requirement(s) of using a computer in classes in each student's major program area. Questions 17 to 25 in Section D measured the student's attitude toward learning using computer technology.

Validity and reliability of the Instrument

In order to establish the content (face) validity of the instrument, the researchers presented it to a panel of experts based on their experience in the related field. The panel was asked to validate the content of the survey instrument by ensuring the overall inclusiveness of all the variables under investigation and to verify that it addressed the research questions. The experts were also asked to review the survey for things such as unclear instructions, confusing, ambiguous or repetitive items, and overly complex or difficult sentence structure. The researchers revised the instrument based on the constructive feedback received from the panel.

Gay et al. (2006) indicated that "reliability is the degree to which a test (or instrument) consistently measures what it is measuring" (p. 139). They further added, the more reliable an instrument is, the more confident the researcher can be regarding the data collected using such instrument. To establish the reliability of the survey instrument used, the researchers employed a test/retest method using 25 students, who agree to participate. These students were not the subjects for this study. The same survey was completed by the participants twice. There was a waiting window of one week between the first and second administration of the instrument. The correlation coefficient value was $r = 0.81$, $p. \leq 0.05$. In addition to the test/retest method, the researchers performed a Cronbach's Alpha reliability test, an internal consistency test, to determine "how all items on a test (an instrument) relate to all other items and to the overall test itself" (Gay et al., 2006, p. 142). The Cronbach's Alpha value for various sections of the instrument ranged from 0.52 to 0.88.

Data collection procedures

25-item questionnaire was administered to the participants of randomly selected class sections of Computer Applications during regularly scheduled class sessions. The researcher introduced himself, explained the purpose of the visit, and emphasized that participation was totally voluntary. Voluntary participation was ensured both through explicit verbal and written explanations. The participants were informed that they could withdraw from the study at any time and that their participation would in no way influence their academic standing in the class where the questionnaires were distributed. The questionnaire took about 15 to 20 min to complete. Students were encouraged to fill out all aspects of the questionnaire. The researcher interacted with the students up to two times during the course of the study. The initial interaction was on the day the survey was conducted. The second interaction only occurred if any participant expressed interest in seeing and/or obtaining the summary report of the research findings.

Data analyses

Research Question 1 asked "Are there significant differences among groups of students based on students' perceived effectiveness of computer-mediated learning and demographics?" The researcher used T-tests and Analysis of Variance (ANOVA) to analyze the data obtained for this question. When a significant difference was found using ANOVA, an appropriate post hoc test was used to identify where difference occurred.

Both correlational and descriptive statistics for the questions that explored the various relationship(s) between variables: students' perceived effectiveness of computer-mediated learning and grade point average in research Question 2; and again in Question 3 that explored the relationship between the requirement of using a computer for the class(es) in students' major program areas and students' attitude toward (future) learning using computer technology.

RESULTS

Survey responses

A total of 129 students were enrolled in the selected Computer Applications classes. Among them, 112 students volunteered to participate in the study, resulting in a participation rate of 87%.

Description and computation of scores for the scale

The researcher used a five-point Likert scale to collect participants' responses for a number of sections (B through D, or questions 8 through 25) in the survey instrument (Appendix A). A Likert scale was used to allow the participants to express their perceptions in the areas under investigation. The Likert scale used in the study is shown in Table 1. In this study, the means for Likert scale items were interpreted using the scale shown in Table 2.

Table 1. The Five-Point Likert Scale used for college students' perceptions of computer-mediated instruction/learning.

Five-Point Likert Scale	
Scale	**Description**
1	Strongly disagree
2	Disagree
3	Agree
4	Strongly agree
-	Not applicable (response ignored)

Table 2. Interpretation of Likert scale mean score values.

Interpretation of mean score values	
Scale	**Description**
1.0 1.49	Strongly disagree
1.50 - 2.49	Disagree
2.50 - 3.49	Agree
3.50 - 4.00	Strongly agree

Table 3. Frequency and percentage analysis of the participants by gender.

Gender	Frequency	Percentage (%)
Male	51	45.50
Female	61	54.50
Total	112	

Table 4. Descriptive statistics based on age.

	N = 112	Minimum	Maximum	Mean	Std. Deviation
Valid N	112	18	55	21.86	5.83

Demographic information

Gender

The frequency distribution for this variable is summarized in Table 3. As illustrated in the table, no great discrepancy was found between female and male participants, as the number of female students was only slightly more than that of the male students.

Age

As shown in the Table 4, the youngest participant was 18 years old, with the oldest participant being 55. The mean age of the students in this study was 21.86 years with a standard deviation of 5.83 years. Figure 1 illustrates the number of students grouped by age.

Major

Table 5 summarizes the majors (areas of concentration) as reported by the participants. Biological Sciences, Business, and Education were three popular areas, accounting for more than half of the sample population (68%).

Class rank

Student rank was classified as freshman, sophomore, junior, senior, graduate-master's, graduate-specialist, graduate-doctoral and non-degree students in this study. Figure 2 shows among the participants, that the great majority were undergraduate students, with numbers fairly evenly distributed between freshmen, sophomores, juniors and seniors.

Table 5. Frequency and percentage analysis of the participants by major.

Major	Frequency	Percentage (%)
Agriculture Economics	2	1.80
Animal & Dairy Sciences	7	6.30
Biological Sciences	20	17.90
Business	20	17.90
Communication	3	2.70
Education	36	32.10
Engineering	5	4.50
English	1	0.90
Geosciences	1	0 .90
History	3	2.70
Landscape Architecture	1	0 .90
Philosophy & Religion	1	0 .90
Psychology	1	0.90
Sociology	4	3.60
Undecided	7	6.30
Total	112	

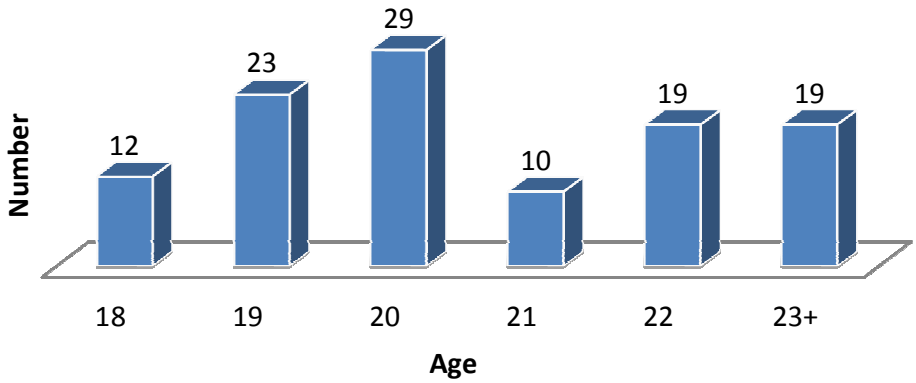

Figure 1. Number of participants grouped by age.

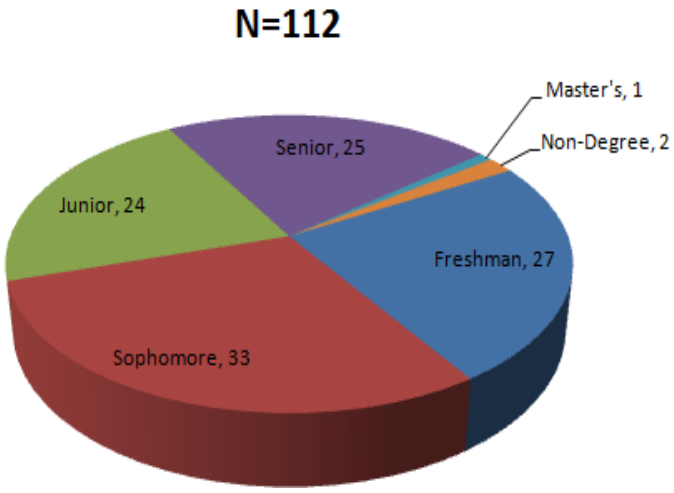

Figure 2. Number of the participants by class rank.

Table 6. Frequency and percentage analysis of participants' GPA.

GPA	Frequency	Percentage (%)
Below 1.00	1	0.90
1.00-1.49	2	1.80
1.50-1.99	5	4.50
2.00-2.49	17	15.20
2.50-2.99	30	26.80
3.00-3.49	18	16.10
3.50-4.00	39	34.80
Total	112	

Table 7. Frequency and percentage analysis of the participants' occupation.

Occupation	Frequency	Percentage (%)
Legal Secretary	1	0.90
Library Associate	1	0.90
Preschool Teacher	1	0.90
Sales Representative	1	0.90
Student	108	96.40
Total	112	

Table 8. Frequency and percentage analysis of the participants' experience in computer use for learning.

Number of years	Frequency	Percentage (%)
0 – 5	52	46.40
6 – 10	41	36.60
11 – 15	15	13.40
16 – 20	4	3.60
Total	112	

Grade point average (GPA)

The frequency distribution for participants' grade point average (GPA) is summarized in Table 6. As shown in the table, students' GPAs were closely in-line with their cumulative grade point average (CGPA) reported earlier.

Occupation

Table 7 illustrates participants' occupation information. Overwhelmingly, almost all of them were full-time students in the university.

Experience (Number of Years) in computer use for learning

As illustrated in Table 8; 41 of the 112 participants, or 36.60%, had a minimum of 6 years using computers for learning. Fifteen students or 13.40%, had a minimum of 11 years of experience in computer use for learning.

Research Question 1: Are there any significant differences in students' perceived effectiveness of computer-mediated learning based on their demographics?

A T-test revealed a statistical significant difference between male students and female student, $t(110) = -2.46$, $p < 0.05$, for survey Item No. 13: "I think effective Computer-Mediated Learning ensures that students are engaged and motivated in learning (the given subject)." Female students' mean score was higher than that of male students' (M = 3.25 vs. 2.92).

Table 9 shows the descriptive statistics of the participants' perceived effectiveness of computer-mediated learning based on their grade point average (GPA). The mean scores ranged from 2.83 (low) to

Table 9. Descriptive statistics of the participants' perceived effectiveness of computer-mediated learning based on grade point average (GPA).

GPA	N	Mean	SD	Min.	Max.
Below 1.00	1	2.83	-	2.83	2.83
1.00 – 1.49	2	3.25	0.35	3.00	3.50
1.50 – 1.99	8	3.02	0.23	2.67	3.33
2.00 – 2.49	18	3.11	0.29	2.83	4.00
2.50 – 2.99	36	3.17	0.46	1.83	4.00
3.00 – 3.49	10	3.23	0.38	2.83	4.00
3.50 – 4.00	37	3.38	0.35	2.83	4.00
Total	112				

Table 10. Test score for the homogeneity of variance assumption of the participants' perceived effectiveness of computer-mediated learning based on grade point average (CGPA).

Levene's test statistic based on GPA	*p*
1.23	0.30

Table 11. ANOVA Test of participants' perceived effectiveness of computer-mediated learning based on cumulative grade point average (CGPA).

Source of variation	Sum of squares	*df*	Mean Square	*F*	*p*
Between groups	2.16	4	0.54	3.47	0.01*
Within groups	16.20	104	0.16		
Total	18.36				

*$p \leq 0.05$.

3.38 (high), indicating the participants of all GPA groups in the study agreed that overall computer-mediated learning was effective.

Table 10 shows the result of the homogeneity of variance assumption for the participants' perceived effectiveness of computer-mediated learning based on grade point average (GPA). The test score indicated that the assumption was not violated with $p. > 0.05$.

As illustrated in Table 11, a one-way analysis of variance (ANOVA) was used to examine if there were significant differences of participants' perceived effectiveness in computer-mediated learning among groups based on their grade point average (CGPA). Both "Below 1.00" and "1.00 to 1.49" groups were excluded from the analysis due to insufficient number(s) of students represented in each group (one participant in the "Below 1.00" group and two participants in the "1.00 to 1.49" group). The results indicated that there was a significant difference among groups F (4, 104) = 3.47, $p. < 0.05$.

In order to discover where the difference identified by the ANOVA occurred, the researcher performed a Tukey HSD post hoc test shown in Table 12. The test revealed that students in GPA 3.50 to 4.00 group were significantly different (M = 3.38), from those in the 2.00 to 2.49 CGPA group (M = 3.11), and those in the GPA 2.50 to 2.99 group (M = 3.16). Students with higher GPAs tended to perceive higher the overall effectiveness of Computer Mediated Learning than students with lower GPAs.

Research Question 2: Are there any meaningful relationships between students' perceived effectiveness of computer-mediated learning and grade point average (GPA)?

Perceived effectiveness of computer-mediated learning

Table 13 shows the overall mean score of students' responses for item Nos. 8 through 13 in the Appendix A, which were used to assess the participants' perceived effectiveness of computer-mediated learning. As shown in the table, students in general held an agreed (M = 3.22, SD = 0.39) view of the overall effectiveness of computer-mediated learning.

Table 12. Post Hoc Test (Tukey HSD) of participants' perceived effectiveness in computer-mediated learning based on grade point average (GPA).

Base group	Base group mean	Compare group	Compare group mean	Mean difference	*p*
3.50 – 4.00	3.38	2.00 – 2.49	3.11	0.27*	0.05
		2.50 – 2.99	3.16	0.22*	0.05

*p. ≤ 0.05.

Table 13. Overall mean score of the participants' perceived effectiveness of computer-mediated learning.

Variables	N	Mean	SD	Median	Min.	Max.
Perceived effectiveness of computer-mediated learning	112	3.22	0.39	3.15	1.83	4.00

Table 14. Overall mean score of the participants' grade point average (GPA).

Variables	N	Mean	SD	Median	Min.	Max.
GPA	112	3.16	0.79	3.43	0.57	4.00

Table 15. Pearson product-moment correlation of students' perceived effectiveness of computer-mediated learning and grade point average (MGPA).

Variable	Grade point average (GPA)
Perceived effectiveness of computer-mediated learning	0.21*

* Correlation is significant at the 0.05 level (2-tailed).

Table 16. Overall mean score of the requirement of using a computer by the instructors in students' major program areas.

Variable	N	Mean	SD	Min.	Max.
Requirement of using a computer	112	3.07	0.39	2.11	4.00

Grade point average (GPA)

Table 14 shows that students' GPA ranged from 0.57 (low) to 4.00 (high) and the overall mean score is 3.16, indicating a low "B" average in students' grade point average.

Table 15 shows the Pearson Product- Moment Correlation of students' perceived effectiveness in the area of computer-mediated learning and their grade point average (GPA) ($r = .21$, $p. < .05$). The result revealed that there was a statistical significant, low positive association between the two variables.

Research Question 3: Are there any meaningful relationships between having to use computers for the class(es) in students' major program areas and students' attitude toward learning using computer technology?

Requirement of using a computer

Table 16 shows the mean score of students' responses for item Nos. 14 through 16 in Appendix A, which were used to assess the requirement of using a computer by the instructors in students' major program areas. As shown in the table, students in general agreed (M = 3.07, SD = 0.39) that using the computer (for learning) is required by the instructors in their major program areas.

Attitude toward learning using computer-mediated technology

Table 17 shows the overall mean score of students' responses for item Nos. 17 through 25 in Appendix A, which were used to assess students' attitude toward learning using computer technology. As shown in the table, students in general held a positive view (M = 3.10, SD = 0.39) toward using the computer for learning.

Table 18 shows the Pearson Product- Moment Correlation between each question item of the two variables: Requirement of using computers (items Nos. 14 to 16) and students' attitude toward learning using computer technology (items Nos. 17 to 25).

Table 17. Overall mean score of students' attitude toward learning using computer technology.

Variable	N	Mean	SD	Min.	Max.
Students' attitude toward learning using computer technology	112	3.10	0.39	2.11	4.00

Table 18. Pearson product-moment correlation of the requirement of using a computer by the instructors in students' major program areas and students' attitude toward learning using computer technology.

Variable	Requirement of using a computer by instructors in students' program areas
Students' attitude toward learning using computer technology	0.42*

*Correlation is significant at the 0.01 level (2-tailed).

Summary of findings

Research question one

The first question asked: "Are there any significant differences in students' perceived effectiveness in the area of computer-mediated learning based on demographics?"

A T-test revealed a statistical significant difference between male students and female student, $t(110) = -2.46$, $p < 0.05$, for survey Item No. 13: "I think effective Computer-Mediated Learning ensures that students are engaged and motivated in learning (the given subject)." Female students' mean score was higher than that of male students' (M = 3.25 vs. 2.92).

Based on an ANOVA test, statistical significant differences were also found among groups of students based on their grade point average (GPA) and their perceived effectiveness of computer-mediated learning. A follow-up Tukey HSD test indicates the differences that existed between GPA 3.50 to 4.00 group, 2.00 to 2.49 group, as well as the 2.50 to 2.99 group. Group 3.50 to 4.00 obtained a higher mean score (M = 3.38) than the other two groups, 2.00 to 2.49 and 2.50 to 2.99 (M = 3.11 and 3.16, respectively).

Research question two

The second research question asked: "Are there any meaningful relationships between students' perceived effectiveness in the area of computer-mediated learning and grade point average (GPA)?"

A Pearson Product-Moment Correlation analysis revealed a statistical significant, low *positive* association ($r = 0.21$, p. < 0.05) between the two variables under investigation. Correlational analyses based on individual questions revealed mostly very low associations, despite a statistical significant ($r = 0.26$, p. < 0.01), low *positive* association between students' grade point average (GPA) and perception Item No. 10: "I think effective Computer-Mediated Learning allows knowledge building (that helps relate facts to reality)."

Research question three

The third research question asked: "Are there any meaningful relationships between having to use computers for the class(es) in students' major program areas and students' attitude toward learning using computer technology?" A Pearson Product-Moment Correlation analysis revealed a statistical significance, moderate *positive* association ($r = 0.42$, p. < 0.01) between the two variables under investigation.

In addition, correlational analyses based on individual question items indicated a moderate *positive* relationship ($r = 0.42$, p. < 0.01) between Item No. 16 "I think instructors in my program area require students to use computers outside of the classes" (Requirement of using a computer) and Item No. 17 "It will be essential for me to use computer technology to enhance the process of searching for information for future learning" (Students' attitude toward learning using computer technology).

The findings of correlational analyses based on individual question items also showed statistical significant, low *negative* relationships ($r = -0.32$, p. < 0.01 and $r = -0.26$, p. < 0.01, respectively) between Items No. 14 "I think instructors in my program area rarely address the importance of using (computer) technology in instruction and learning" (Requirement of using a computer) and No. 15 "I think instructors in my program area require students to use computers in classes" (Requirement of using a computer) and Item No. 20 "I prefer to have more teacher-directed than self-directed learning using (computer) technology" (Students' attitude toward learning using computer technology).

DISCUSSION

This study adds to the literature that the results of one-

way analysis of variance (ANOVA) indicated there was a significant difference among groups based on students' grade point average (GPA), regarding their perceived effectiveness of computer-mediated learning. A follow-up Tukey HSD post-hoc test revealed the perceptions of the students whose GPAs were between 3.50 to 4.00 was significantly different from those in the GPA group 2.00 to 2.49 and 2.50 to 2.99. The mean score of GPA group 3.50 to 4.00 was in the upper "agree" range as opposed to mid-"agree" range for GPA groups 2.00 to 2.49 and 2.50 to 2.99.

ANOVA analyses did not reveal any significant differences among groups based on gender and ethnicity. It might be because there has been erosion in the gender gap and digital divide. No significant differences were found between major programs (areas of concentration) which may have suggested that computer-mediated instruction/learning is influencing how many subjects are taught; especially in disciplines (philosophy, history, sociology and so on) where computer technologies were traditionally considered as less effective or contributive in content delivery.

The results of the study showed that the participants agreed that communication is enhanced in a computer-mediated instruction/learning environment. In terms of their perceived effectiveness of computer-mediated learning, the participants overall agreed that effective computer-mediated learning encourages collaborative (group) learning, as well as enables effective communication with the teacher and peers.

This study also supports researchers' claims that conducting classes in a computer-mediated learning environment can effectively facilitate students' knowledge construction (Bentley, 2003) and that adequate use of computer technology can strengthen learners' higher cognitive skills and complex thinking skills (Rakes et al., 2006) by providing significant evidence via students' responses agreeing that effective computer-mediated learning allows knowledge building (that helps relate facts to reality) and promotes in-depth and advanced learning. Participants of this study strongly agreed that effective computer-mediated learning allows building computer skills. This finding supports Cooper and Hirtle's (1999) observation as they reported that through a constructivist pedagogical approach, students could not only obtain the required computer skills but in addition, acquire other skills necessary to solve the real world problems.

This study adds to the literature that there was a statistical significance, low positive association between students' perceived effectiveness of computer-mediated learning and their grade point average (GPA). Correlational analyses between individual items of the two variables revealed that this association especially holds true between students' GPAs and their believing that effective computer-mediated learning allows knowledge building.

More specifically, itemized correlational analyses indicated a statistical significant, moderate *positive* association between "instructors in my program area require students to use computers outside of the classes" and "it will be essential for me to use computer technology to enhance the process of searching for information for future learning." It is also worth noting that the study found a significant *positive* association between "instructors' requirement of using computers for learning outside of the classes" and "I will use the computer for distance education from home in the future." The possible explanations for the findings could be that the students grew in confidence in using computers for learning and their growth in computer self-efficacy by instructors' reinforcement of computer use (in and) outside of the classes. They might also acquire additional benefits and skills which were not intended for the purpose of the class(es), thus are likely to choose learning tasks that are especially related to academics.

Two statistical significant, low *negative* relationships were found, suggesting: (a) the more instructors address the importance of using computer technology in instruction and learning, and (b) the more instructors require students to use computers in classes, the less likely that students would prefer teacher-directed and explorative learning using computer technology. One possible explanation for these findings could be that computer-mediated learning encourages and facilitates self-directed learning.

In conclusion, many factors other than those presented in this study might and could influence students' perceptions, as well as their perceived effectiveness of computer-mediated instruction/learning. It takes explicit knowledge, support and cooperative efforts among administrators, teachers and students to ensure teaching and learning are indeed benefitting from the computer technology.

Limitations

The findings of this research are limited in the following ways:

1. The study procedures involved the self-reporting technique. Thus findings may be affected by participants' physical and emotional state, honesty, accuracy and thoroughness in completing the survey.
2. The findings of this study are limited by both students' and teachers' unique computer background, their direct access to and the availability of the computer technology in their respective major program areas, including computer hardware and software, and peripheral equipment.
3. Students' perceptions are limited to the information obtained from the instrument used in this study and the validity and reliability of the instrument.

Recommendations

Several recommendations for future research can be made as results of this study:

1. Because this study involved only multiple sections of a computer application class offered in Southern Taiwan University, it can be replicated in other institutions across regions since results may vary depending on the educational settings and characteristics of the participants.
2. The sample population size can be increased.
3. An experimental design in a more controlled environment should be used to examine the impact of computer-mediated instruction/learning on students' attitude and motivation, and on students' achievement.
4. To better ensure the overall validity of the instrument, student experts' opinions should also be accounted for in addition to that of a panel of experts. Students will primarily be asked to check for clarity and relevance of the questions.
5. It is recommended that future researchers conduct qualitative studies to substantiate and clarify findings. For instance, researchers can add an interview component to their studies to aid investigation especially in areas where statistical significances are found.
6. It is recommended that researchers add more open-ended questions in the survey and encourage students to complete the questions.
7. In the current study, only students' perceptions were sought. It is recommended that future studies seek teachers' and/or administrators' perceptions and attitude of computer-mediated instruction/learning in comparison to that of the learners'.

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APPENDIX A: Questionnaire

Section A: Demographic information
Please read the following description for each item and provide your response by checking (□) the box that best reflects your opinion and/ or writing down your response in the space provided.

1. What is your gender?

☐ Male ☐ Female

2. What is your age? (Please specify) _____

3. What is your major program area of study? (that is, Human Science-Agricultural Science major, Business-Marketing major, Kinesiology-Sports Medicine major, etc.) _____

4. What is your class rank? Please check only one that applies.

☐ Freshman ☐ Sophomore ☐ Junior

☐ Senior ☐ Graduate - Master's ☐ Graduate - Specailist

☐ Graduate - Doctoral ☐ Non-Degree

5. What is your Grade Point Average (GPA)?

☐ Below 1.00 ☐ 1.00 - 1.49 ☑ 1.50 - 1.99

☐ 2.00 - 2.49 ☐ 2.50 - 2.99 ☐ 3.00 - 3.49

☐ 3.50 - 4.00

6. What is your current occupation? (that is, full time student, nurse, teacher, biologist, etc.) _____

7. What is your experience (number of years) in computer use for learning?

☐ 0 - 5 years ☐ 6 - 10 years ☐ 11 - 15 years

☐ 16 - 20 years ☐ 20 years +

Instructions for section B through D:
Please read the following description for each item and provide your response by *circling* the number that best reflects your opinion from **1- Strongly Disagree (SD)**, **2- Disagree (D)**, **3- Agree (A)**, **4- Strongly Agree (SA).** *Check* **(V) "Not Applicable (NA)"** if any of the statements does not apply to you. Limit ONLY ONE response to each question please.

Section B: Perceived competence of computer-mediated instruction/ learning.

No.	Items	SD	D	A	SA	NA
08.	I think effective Computer-Mediated Learning encourages collaborative (group) learning.	1	2	3	4	
09.	I think effective Computer-Mediated Learning enables effective communication with the teacher and peers.	1	2	3	4	
10.	I think effective Computer-Mediated Learning allows knowledge building (that helps relate facts to reality).	1	2	3	4	
11.	I think effective Computer-Mediated Learning promotes in-depth and advanced learning.	1	2	3	4	
12.	I think effective Computer-Mediated Learning allows building computer skills.	1	2	3	4	
13.	I think effective Computer-Mediated Learning ensures that students are engaged and motivated in learning (the given subject).	1	2	3	4	

Section C: Requirement of using a computer in the class.

No.	Items	SD	D	A	SA	NA
14.	I think instructors in my program area **rarely** address the importance of using computer (technology) in instruction and learning.	1	2	3	4	
15.	I think instructors in my program area require students to use computers in classes.	1	2	3	4	
16.	I think instructors in my program area require students to use computers outside of the classes.	1	2	3	4	

Section D: Attitude of using computer-mediated technology towards (future) learning.

No.	Items	SD	D	A	SA	NA
17.	It will be essential for me to use computer technology to enhance the process of searching for information for future learning.	1	2	3	4	
18.	I will use the computer for distance education from home in the future.	1	2	3	4	
19.	I find it difficult to navigate the World Wide Web.	1	2	3	4	
20.	I prefer to have more teacher-directed than self-directed learning using (computer) technology.	1	2	3	4	
21.	I wish I would never have to use a computer as part of my program studies.	1	2	3	4	
22.	I enjoy using the computer as an integral part of my learning activities.	1	2	3	4	
23.	I prefer to obtain all my course's materials via the Internet, not in paper format.	1	2	3	4	
24.	I prefer online tests to paper-pencil tests.	1	2	3	4	
25.	I do not feel comfortable discussing course related issues through the Web.	1	2	3	4	