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Nursing Students' Evaluation of the Effectiveness of Online Collaborative Learning

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Authors' contributions

The first and corresponding author WWY designed the study, managed literature searches, and performed the statistical analyses, wrote the protocol, and wrote the first draft of the manuscript. Authors JW and CCL managed the analyses of the study as well as revisions. All authors read and approved the final manuscript.

Research Article

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ABSTRACT

Aims: To investigate nursing students' evaluation of the impact of collaborative group work in a web-based learning environment.

Study Design: Correlational Design.

Place and Duration of Study: The study took place in an online, elective "Multimedia Design for Instruction" course, which is offered bi-annually, in a regional campus of Taiwanese Nursing Institute during fall and spring semesters from 2009~2011 academic years.

Methodology: One hundred and ninety seven students participated in the study, including 14 males and 183 females, who aged between 18 and 32. The participants varied in their demographic profiles, for instance, age, the length of their professional work experience, experience of using computers for learning, and etc. A self-report survey was used to collect data. The data collected were analyzed using summary descriptive statistics, correlations, and a multiple regression analysis.

Results: The results revealed that the variables including gender, complexity of tasks, strong group partners, class preparation, ability to use required media, and interest in class topics, yielding $R^2 = .37$, $R^2_{adj} = .33$, $F(8, 188) = 9.83$, $P < .001$, had significant impact on participants' perceptions of online collaborative learning. This model explained 33% of the

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variance in participants' perceptions of the effectiveness of collaborative learning.

Conclusion: Overall, students rated the effectiveness of online collaborative learning as "high." The impact of students' computer skills and their ability to use the required media needs additional examination. It is also suggested that the need for prerequisite skills and competence in using the course management software prior to taking an online collaborative class should be studied. The results of the multiple regression indicated that the independent variables examined in this study, although having an impact on students' perceptions of the effectiveness of collaborative online learning, suggest that other models might identify variables that have a greater impact.

Keywords: Online collaborative learning; nursing education; online learning effectiveness.

1. INTRODUCTION

In education the importance of collaborative learning is deeply entrenched into our understanding [1,2,3], and distance learning can be a solitary experience that overlooks this need for collaboration. Educators strive to identify methods for learners to support, broaden and scaffold one another's thinking. Literature continues to support online collaborative learning and the positive effects it has on students [4]. The belief now appears to have become widely accepted that students learn more effectively when they observe, interact and collaborate with others [3,5,6,7]. As a result, more and more instructors are incorporating collaborative learning as a major instructional strategy in the online environment. As technology advances with breath-taking velocity, schools continually try to catch up. Today, most of today's students use new online technology on a daily basis as they integrate a variety of media through what they see as routine communications. Students use many add-on technological tools to create, share, and edit audio and video-rich documents online, and interact with others as they post their opinions and comments.

Research studies have been increasingly catalyzed by social and constructive perspectives on learning. When learners are placed in an environment designed based on the social constructivist theories in order to facilitate meaningful learning, collaborations and interactions between the learners occur [8,9]. It is then knowledge is constructed, and experiences and skills shared. The outburst of web based technology mediated learning seems to be able to stimulate learning process and produce persuasive learning outcomes [10]. While many studies have been completed related to online collaborative learning [11,12], few have located their focuses on the factors involved in collaborative learning. In fact, those that do, tend to involve single factors that enhance learning. In this study the researchers considered multiple variables to identify the impact of those factors on online collaborative learning.

1.1 Theoretical Framework

Brown, Collins and Duguid [13] assert that students need to be able to work with and listen to others, and to develop ways of dealing with complex issues and problems that require different kinds of expertise. To bring out expected learning outcomes in the online classroom, each person's contribution needs to be respected, and the community as a whole should be able to synthesize diverse views [14]. An emphasis on collaboration, as an essential element of this process, can strengthen group processing skills, subsequently enhancing citizenship in a diverse democracy [15,16].

Numerous studies have shown that learning through collaboration, as compared to competitive or individual learning, usually results in higher achievement, better psychological connections (caring, support, and commitment), greater psychological health, social competence, and self-esteem [17,18,19]. It has also been argued that incorporating well-planned collaborative activities benefits teachers as well as their students, since higher order thinking skills are more likely to be generated [20,21,22], and impact the learning process by improving socialization skills as well as enhancing critical thinking [23,24]. Other benefits of online collaboration that have been cited include reflection, peer feedback [25], and the reduction of anxieties in social situations [26].

According to Johnson and Johnson [27], positive interdependence, which is the heart of effective collaboration, emerges when each member in a group perceives that he or she cannot succeed unless the group does. Another element for effective collaboration is to promote interaction, which exists when group members act as trustworthy members by acknowledging and challenging one another's ideas and facilitating one another's efforts. To ensure each member's active participation in a group project, the group leader should require and accept the individuality of each participant. This can be achieved when each group member's performance is assessed. Using collaborative learning necessitates that group members have social skills for trust building within the team, clear communications, and constructive conflict resolution. Group processing includes monitoring all members' work to ensure the quality of the work, to facilitate social interaction, and to ensure reciprocal interaction so that group members can collaborate effectively [28].

With the advent of the Internet and an array of new communicative media, there have also been many attempts to incorporate collaborative learning methods in online environments. Hiltz and Turoff [29] suggest that collaborative learning activities which are well-suited for online environments include debates, group projects, case study discussions, simulations, role-playing exercises, the sharing of solutions for homework problems, and the collaborative composition of essays, stories and research plans. However, in reality, most online collaborative work is usually relegated to discussion board conversations, in which students merely generate a dialogue with their peers about the weekly readings. While this type of activity is valuable, the extent of actual collaboration is usually quite limited.

1.2 Research Questions

The following questions were developed to guide this study:

1. Are there any meaningful relationships among the variables measured, namely, computer competence, complexity of tasks, having good group partners, class preparation, class communication, ability to use required media, self interest in class topics and effectiveness of online collaborative learning?
2. What factors, as perceived by the students, seem to impact the overall effectiveness of online collaborative learning?

2. METHODOLOGY

The current study addressed collaborative learning needs of the students. Not only did the researchers seek to identify how other researchers have addressed this problem, but sought to identify how students evaluate the importance of various factors related to the effectiveness of online collaborative learning. It is unique in that it examined eight factors

that students have deemed as important to online collaborative learning, including 1. computer competence, 2. complexity of tasks, 3. having good group partners, 4. class preparation, 5. class communication, 6. ability to use required media, 7. Self-interest in class topics and 8. effectiveness of online collaborative learning.

2.1 The Context of the Study

The reported study took place in an online, elective “Multimedia Design for Instruction” course, which is offered bi-annually. The purpose of the course was to provide students with an overview of hypermedia/interactive multimedia technology via working with various hypermedia/multimedia tools. Students were introduced to the design and production process of developing multimedia applications and have the opportunity to learn various tools, concentrating on different aspects of the technology, for instance, text, graphics, audio, video as well as animation. Through working with these tools, students were expected to develop an understanding and the skills required for the creation of instructional tools for application in education and nursing industry settings. Also, they were required to apply design principles necessary for the creation of hypermedia/multimedia when developing multimedia-based applications.

2.2 Participants

The accessible student population for the study was approximately 2000 nursing major students enrolled in a regional campus of Taiwanese Nursing Institute during fall and spring semesters, 2009~2011 school years. These students were fairly evenly divided into 40 classes, 22 classes of which were 4-year and 2-year college students and the remaining 18 classes were continuing education students. The researchers used a convenient sampling technique to select the subjects for the study. All students (total of 210) who took the Multimedia Design for Instruction class were encouraged to participate in the study. In the end, 197 students agreed to join, accounting for approximately 1/10 of the overall population. The participants varied in their age, the length of their professional work experience, experience of using computers for learning, and were at different stages of their degree, as far as their class rank was concerned. Mass majority of the participants were female nursing students, accounting for nearly 93% (183 of 197). The youngest participant was 18 years old, with the oldest participant being 32. The mean age of the students in this study was 20.56 years.

As shown in Table 1, three quarters of the participants were 4-year college students, and less than a quarter of them were continuing education students.

Table 1. Frequency and percentage analysis of the participants by division/rank

Division/Rank	Frequency	Percentage
4-yr College Freshmen	49	24.90
4-yr College Sophomores	36	18.30
4-yr College Juniors	34	17.30
4-yr College Seniors	32	16.10
Continued Education	46	23.40
Total	197	

Fig. 1 shows that nearly all of the participants were full time students and 1/10 of the participants were employed either full-time or part-time as nurses. Most of them (195 of 197) had worked 0~5 years. More than greater half (148 of 197) of the participants indicated that they had “6~10 years” of experience using computers in a teacher/learning environment.

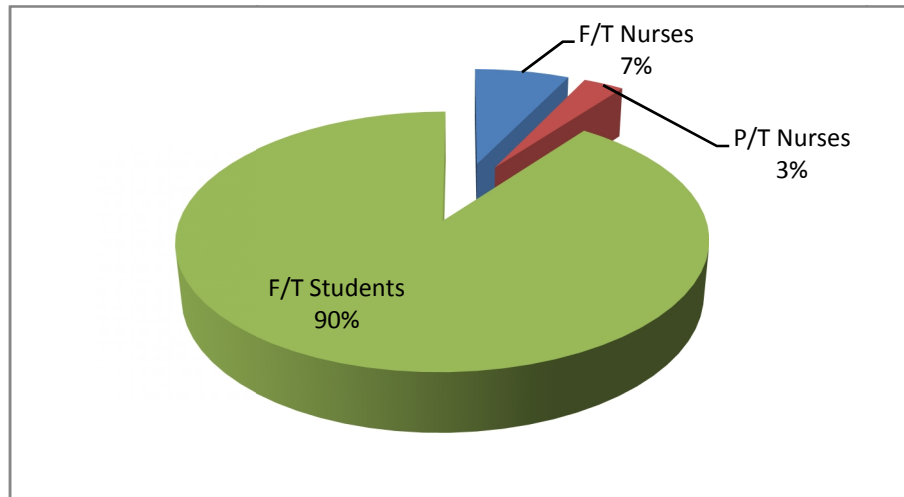


Fig.1. Frequency and percentage analysis of the participants by employment

2.3 Data Collection and Procedures

As previously mentioned, at the end of each semester, a survey was administered to the students who were enrolled in this particular multimedia design for instruction class. Voluntary participation was ensured both through explicit verbal and written explanations. The participants 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. Participants were informed verbally and in writing that they could decline to answer any items on the questionnaire. The subjects gave their consent by completing and returning the questionnaire. A total of 210 questionnaires were administered and 197 were returned, resulting in a response rate of 94%.

2.4 Materials

A self-report survey was used to collect data for this study. The instrument was developed by the researchers based on information obtained from the review of literature in the area of teaching/learning in the online settings and the inclusion of the variables within the multiple regression analyses were set forward based upon a number of previous studies [30]. As the Internet and web-based technologies might conveniently help nurse educators prepare students adjust for the complex health care system [31], the administrators and educators must highlight and address the importance of the critical awareness of the relationships among technology, culture, and society [32].

The questionnaire was made available monolingually in student's native language, Mandarin Chinese in order to avoid receiving any false response due to misinterpretations of the item(s). The questions were in four-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).

2.5 Validity and Reliability of the Instrument

In order to establish the content (face) validity of the instrument, which was stated by Gay, Mills, & Airasian [33] as the instrument measuring what it is intended or what it claims to measure, the researchers presented it to a panel of three experts in the field of distance learning, teaching pedagogy, and statistical analysis, who were asked to validate the content of the survey instrument by ensuring the overall inclusiveness of all the variables under investigation. 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 then revised the instrument based on the constructive feedback received from the reviewers.

To establish the reliability of the survey instrument used, the researchers employed a test/retest method using 25 students, producing a score of .80. These students were not the subjects for this reported study. There was a waiting window of one week between the first and second administration of the instrument. In addition to the test/retest method, the researchers also performed Cronbach's Alpha reliability test. Cronbach's Alpha value was .85, $p \leq .05$.

2.6 Analyses

The data collected were analyzed using summary descriptive statistics, correlations, and a multiple regression analysis. The independent variables for the multiple regression were gender, computer ability, complexity of tasks, importance of the group partners, preparation for class, ability to use required communication media, participation in discussion options, and self interest in class topics. The dependent variable was participants' perception of the effectiveness of online collaborative learning.

3. RESULTS

3.1 Description and Computation of Scores for the Scale

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 2.

Table 2. Four-point Likert scale for students' evaluation of online collaborative learning

Scale	Description
1	Strongly Disagree
2	Disagree
3	Agree
4	Strongly Agree
-	Not Applicable (response ignored)

In this study, the means for Likert scale items were interpreted using the scale shown in Table 3.

Table 3. Interpretation of Likert scale mean score values

Scale	Description
.00-1.00	Strongly Disagree
1.01-2.00	Disagree
2.01-3.00	Agree
3.01-4.00	Strongly Agree

As shown in Table 4, the participants rated the importance all the variables “high” with the exception of “the complexity of the tasks required” and “the importance of participating in the variety of discussion options available in the class” which they rated as moderate. They rated their “individual computer ability” as low. This was the only variable that the participants rated as low. They rated the effectiveness of online collaborative learning as high.

Students completed the surveys at the conclusion of the classes, and it is possible that their rating of their “individual computer competence” might have been impacted by the experience they had using the variety of media they were required to use during the class and the course management system used throughout the class.

Table 4. Summary of variable data

Variables	Scale Data (1- very low to 4- very high)
1. Your evaluation of your computer ability	2.21
2. Your evaluation of the complexity of tasks required in the online class	3.23
3. Your evaluation of the importance of selecting a good group partner	3.67
4. Your evaluation of the importance of regular preparation for the online class	3.90
5. Your evaluation of your ability to use various communication media available in the online class	3.84
6. Your evaluation of the importance of participating in the variety of discussions options available in the online class	3.07
7. Your evaluation of the importance of your individual interest in the topics presented in the online class	3.50
8. Your evaluation of the effectiveness of online collaborative learning	3.76

Research Question 1: Are there any meaningful relationships among the variables used in the study, namely, computer competence, complexity of tasks, good group partners, class preparation, class communication, ability to use required media, self interest in class topics and effectiveness of online collaborative learning?

Table 5 was used to interpret the association among the variables in the study, using the model proposed by Hollander & Wolfe [34] and Howell [35].

Table 5. Interpretation of associations

Strength of Association	Interpretation
.00 - .19	Very Low
.20 - .39	Low
.40 - .59	Moderate
.60 - .79	Strong
.80 - 100	Very Strong

As shown in Table 6, there were low positive, but significant associations between the independent variables “ability to use various communication media available in the online class,” “participation in the variety of discussions options available in the online class,” “individual interest in the topics presented in the online class,” and the dependent variable, “evaluation of the effectiveness of online collaborative learning.” There was a low negative, but significant relationship between the “complexity of the tasks required in the class” and the “ability to use the communications media available in the class.”

There was a moderate association between “the importance of a good partner” and “the importance of regular preparation for class.”

Table 6. Pearson product moment correlations

Variables	1	2	3	4	5	6	7	8
1. Computer ability	1							
2. Complexity of tasks	.18*	1						
3. Importance of selecting good group partner	.22*	.18*	1					
4. Importance of regular preparation for the class	-.22**	-.18*	.41**	1				
5. Ability to use various communication media	-.31**	-.27**	.28**	.30**	1			
6. Participation in a variety of discussions options	.23**	.26**	-.02	-.07	-.24**	1		
7. Individual interest in the topics presented in the class	.07	-.33**	.39**	.18*	.28**	.16	1	
8. Effectiveness of online collaborative learning	-.04	.04	.08	.09	.30**	.27**	.29**	1

N = 197. * *P* ≤ .05. ** *P* ≤ .01.

Research Question 2: What factors, perceived by the students, seem to impact the overall effectiveness of online collaboratively learning?

A multiple regression analysis, as shown in Table 7, was used to identify the impact of the independent variables (gender, evaluation of computer ability, complexity of tasks, importance of selecting a good partner, importance of preparation for class, ability to use communication media, participation in discussion options, and interest in class topics) on students perceptions of the effectiveness of collaborative learning. Regression results indicated that the model significantly predicted a portion of the variance in participants'

perceptions of online collaborative learning, $R^2 = .37$, $R^2_{adj} = .33$, $F(8, 188) = 9.83$, $P \leq .001$. This model explained 33% of the variance in participants' perceptions of the effectiveness of collaborative learning.

Table 7. Multiple regression

	B	SE	β	t	F	Total R^2	Total R^2_{adj}
					9.83 (8, 188)***	.37	.33
Intercept							
1. Gender (female = 0, male = 1)	.67	.14	.47***	4.78			
2. Computer ability	.17	.10	.15	1.72			
3. Complexity of tasks	.24	.05	.43***	4.47			
4. Importance of selecting good group partner	-.54	.12	-.62***	-4.69			
5. Importance of regular preparation for the class	.39	.11	.36**	3.45			
6. Ability to use various communication media	.62	.10	.57***	6.19			
7. Participation in a variety of discussions options	.13	.07	.16	1.95			
8. Individual interest in the topics presented in the class	.52	.13	.36***	3.91			

Note: * $P < .05$; ** $P < .01$; *** $P < .001$.

4. DISCUSSION

This study was conducted to investigate nursing students' evaluation of the impact of collaborative group work in a web-based learning environment. The independent variables examined in the study predicted a portion of the variance of participants' perceptions of the effectiveness of online collaborative learning. Based on the correlational and regression analyses, several notable findings have been highlighted in the table below, followed by detailed interpretations:

Table 8. Highlighted findings

No.	Variable 1	Variable 2	Way of Analysis	Relationship
1	Ability to use required communication media	Regular preparations for class	Correlation	Negative
2	Complexity of Tasks	Interest in class topics	Correlation	Negative
3	Having good group partners	Interest in class topics	Correlation	Positive
4	Having good group partners	Regular preparations for class	Correlation	Positive
5	<ul style="list-style-type: none"> ◇ Student's ability to use communication media ◇ Complexity of Tasks ◇ Individual Interests 	Effective Online Collaborative Learning	Regression	Positive
	<ul style="list-style-type: none"> ■ Having good group partners 			Negative

4.1 Interpretations

Basing on the highlighted findings in Table 8, the following interpretations were given:

1. This study adds to the literature that there was a *negative* relationship between how student evaluated their “ability to use the required communications media” and how students evaluated the “importance of preparation for the class regularly.” Overall, the students rated the importance of having the abilities to use communication media required in the class as “high.” However, as the media used in the course gradually became more complex, students tended to rate their ability to use the media lower. The association between these two variables could present a challenge to instructors who perhaps don’t see basic skill competence as a variable in the learning environment and who would not address this important issue.
2. This study also adds to the literature that there was a significant, *negative* relationship existed between “participants’ evaluation of the difficulty of the tasks” and “participants’ interest in the topic.” As tasks became more difficult, students tended to be less interested in the topic and became more concerned with academic aspects of the course such as required papers, examinations, and presentations. On the other hand, they indicated that the more interested they were in the class topic, the lower they rated the complexity of the tasks.
3. *A positive* relationship was noted between students’ “interest in the class topic” and the importance they placed on “selecting a good partner” for collaborative learning. This result echoed some previous research findings as researchers such as Petress [36], Pavitt & Johnson [37] suggested that various learning activities must be incorporated into learning experiences between or among students in which interactivity, communication, and collaboration take place with resulting subject matter understanding and learner satisfaction. Thus, when learners in a coherent collaborative group are exposed to knowledge scaffolding and understanding that has been constructed by their own activities in this complex process, their satisfaction level is elevated. Thus, their satisfaction level can be positively associated with the complexity of the collaborative learning tasks [38].
4. In this study, “the importance of a good group partner” showed positive, low to moderate associations with “regular preparation for classes.” Students who saw the need for good partners also saw the need to prepare for class and to make a meaningful contribution to the group assignment. This finding is in contrast to the previous studies [39,40], which suggested that students often avoid partners on projects due to the lack of motivation by others in the group, leaving one person to complete the project for a good grade, while the others contribute nothing. Students avoid partners in such groups because there is always one member who believes that he or she is the “expert” on the subject. This leads to resentment by other group members, decreasing their motivation to participate and their willingness to listen to their “expert” partner’s ideas, thereby lowering their confidence and self-esteem. In addition, Thompson & Ku [41] stated that some students avoid group partners because they are shy, leaving them distant and less willing to vocalize their ideas because of their feelings of insignificance and worthlessness by other group members.

5. The multiple regression showed that the six out of eight independent variables under investigation had effects on students' evaluation of the effectiveness of collaborative online learning, producing $R^2 = .37$, $R^2_{adj} = .33$, $F(8, 188) = 9.83$, $P \leq .001$. *Student's ability to use various communication media*, *Complexity of tasks*, *Individual interests* had significant positive regression weights, indicating students with higher scores on these scales perceived more positively about the overall impact of the online collaborative learning, after controlling for the other variables in the model. *Selection of a good group partner* had a significant negative weight, indicating students scored higher in this criterion perceived less positive of the overall impact of the online collaborative learning (a suppressor effect). This finding was consistent with that of Krejins, Kirschner & Jochems [42], providing that students felt reserved about working in a group with a good/strong partner, because they may be seemed less contributive to the group as a whole and is likely to lessen the effectiveness of group participation. *Student's own computer ability and Participation in the discussions* did not contribute to the multiple regression model. These findings add to the literature by presenting to the field instructors some critical factors when it comes to planning for effective collaborative learning tasks/activities online.

5. CONCLUSION

Overall, the participants' perceptions of the effectiveness of collaborative online learning were positive. The classes were structured so that the complexity of the tasks required in the class increased each week, and students were required to use and integrate more of the communication media available to them each week. The relationships among students' skill level in using communications media, their ability to integrate media, and their competence related to content of the class might have all contributed to their view of the effectiveness of online collaborative learning. The independent variables "ability to use various communication media," "participation in class discussion options," and "interest in the topics of the class" all showed a positive association to participants' perception of the effectiveness of online collaborative learning. Together, these variables of the study predicted 34 percent of the variance in participants' perception of the effectiveness of collaborative online learning.

In the current study, there was a negative relationship between participants' evaluation of their computer ability and their ability to use the required class media. Students who reported their computer ability as low tended to rate the importance of being able to use the required course media as "high." They associated difficulty using the required course media used in the online class with their computer ability. For some of the participants, this was their first online class, and the mechanics of taking an online class appeared to have an impact on their performance in the class. Accessing and downloading class materials, participation in chat rooms, social networking, mobile media, messaging, collaborative group work, collaboration on papers with document sharing, critiquing, tracking changes, and markup all posed technical challenges to some of the participants. It is possible that their lack of technical skill, along with their lack of experience in an online collaborative environment, had an impact on their perception of the effectiveness of online collaborative learning.

The students who participated in this study rated their computer ability as low, yet they rated their ability to use the communication media available in the class as high. Also, there was a negative relationship between participants' rating of their computer skill and their ability to use the communications media available in class. This finding might be a result of the

exposure participants might have with online classes and the course management software used for the class. Once a student is online and engaged in online instruction, the communications media and the course management software present an entirely new set of skills. The online experience can be a daunting task if it is the student's first experience with an online class, and if the student has a negative experience the student might associate that experience with computer skills.

Overall, students rated the effectiveness of online collaborative learning as "high." The impact of students' computer skills and their ability to use the required media needs additional examination. It is also suggested that the need for prerequisite skills and competence in using the course management software prior to taking an online collaborative class should be studied. The technical aspects of a truly integrated online collaborative learning experience relies on students' ability to navigate their way through the course management system, to use the media available to them, and to collaborate via an multimedia learning environment. How much these basic technical skills contribute to students' impressions of the online collaborative experience and their actual performance in the class is unknown and should be studied.

5.1 Limitations of the Study

The findings of this study should not be generalized to other populations. Although anonymity of the participants was assured, the findings are limited to the honesty of the participants in completing the instrument. It is possible that students might have responded in a way that presents them as more knowledgeable, competent, and hard working. Although the researchers strived to present a neutral view of collaborative online learning, it is possible that questions were presented in such a way that developed bias based on their desire to present an effective collaborative online program.

The researcher's data is limited to the online postings and responses that the students submitted. There were no personal discussions or dialogue to draw additional data from. The lack of qualitative data is a limitation of the study.

5.2 Implications for Further Research

Two variables examined in the study were rated "low/less significant" by the students: computer ability and importance of participating in the variety of discussion options available in the online class. Because both of the factors are related to the student's knowledge of computers and computer software, there seems to be reason to consider additional instruction concerning computer use and application specifically that will promote successful self-efficacy in the online course (Du, et al, 2008 [4]).

There was also a significance difference in male and females assigned importance of choice of a group partner. Males found this factor as much more important. Knowing whether the increased importance of choice of partner is a trend in all academic group work is of interest. Knowing more about gender and gender roles related to academic responsibilities seems significant.

Variables that impact students' perceptions of effective online collaborative learning merit additional research. Models including variable not examined in this study should be

considered, as well as additional research on the impact of the use of various media, participation in online discussion, and generating interest in the class topics.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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