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# Improving academic achievement and motivation through online peer learning

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## Abstract

The motivation to engage students has been a challenge in teaching and learning statistics. This study investigates the effectiveness of online peer learning in enhancing students' academic achievement and promoting their motivation. The researcher employed a quasi-nonequivalent (pre- and posttest) control group design to investigate the effectiveness of online peer learning. The participants in this study involved a total of 193 students taking Statistics as a core subject in the matriculation program of a private higher learning institution. The data were obtained from pre- and posttest results and a structured questionnaire. Results of *t*-tests indicated that the experimental group reported a significant difference in motivation and that this subsequently contributed to a significant difference in academic achievement. This study explicates the success of online peer learning in enhancing students' academic achievement and facilitating their motivation. These findings may be useful in supporting the idea that online peer learning does facilitate statistics learning among matriculation students.

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## 1. Introduction

The challenges of learning statistics have caused difficulty in motivating and engaging students (Ben-Zvi & Garfield, 2008). One of the important factors in teaching statistics is student motivation (Hulsizer & Woolf, 2009). Daniels (2008) explained that students' motivation is an important criterion in learning. Johnson and Aragon (2002) suggested the use of online learning environment as a challenge to address individual differences, motivate the student, and encourage social interaction. When students have confidence and are motivated, a high level of participation is sustained and thus a better understanding of the material is gained (Fisher & Baird, 2005). The purpose of the present study is to investigate the effectiveness of online peer learning in improving students' academic achievement and in enhancing their motivation.

Peer learning promotes the development of learning outcomes, teamwork, critical enquiry and reflection, communication skills, and learning meaningfully (Boud, 2001). Peer learning, as defined by Topping (2005), is the acquisition of knowledge and skills through active help and support among stated equals or matched companions. Thurston and Topping (2007) reasoned that peer learning as a technique is widely used to promote attainment in students. Students are motivated to review, learn, and comprehend the material when they are put into a teaching

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role (Cavallaro & Tan, 2006). This situation regulates students in the working process, supporting each other, and thus ensuring that their learning goals are fulfilled (Liaw, Chen, & Huang, 2008).

Social constructivism as a theoretical model provides a sound base for analyzing the peer learning model in preparation for developing an effective learning environment that could improve students' academic achievement. Peer learning within groups values cooperation above competition and encourages greater respect (Boud, 2001). Social constructivism argues that students can, with help from experts, grasp concepts and ideas that they cannot understand on their own. Through the process of sharing experiences and discussion to build knowledge, students would learn more. Sinclair (2005) argues that peer learning allows students to actively convey ideas from their peer influence.

One Vygotskian social constructivist notion, which has significant implications for peer learning, is that of the zone of proximal development (ZPD), which is defined as the “*distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers*” (Vygotsky, 1978, p. 86). The ZPD emphasizes the idea that effective learning requires support and guidance from others. This zone fosters a meeting place for learners to improve the ability of problem solving through collaboration with a peer (Hartwig, 2008).

Thurston and Topping (2007) reported that co-construction of new cognitive structures can be obtained by peer tutors acting to provide support and scaffolding besides managing the learning and activities to keep them in ZPD. A learner's knowledge can be extended beyond the limitations of physical settings through a process of negotiation and scaffolding (Daniels, 2001). As suggested by Girasoli and Hannafin (2008), teachers can use question prompting techniques to help students learn cognitive strategies for building better understanding, besides encouraging students to elaborate their thoughts and presenting multiple explanations.

The online environment provides an array of scaffolding features to support learning (Girasoli & Hannafin, 2008) and provides active and engaging activities for students, besides giving opportunities for students to construct knowledge rather than just be exposed to the transmission of knowledge (Hong, Lai, & Holton, 2003). The fact that the online environment provides the out-of-school learning environment as a complementary and reinforcement agent, which broadens the learning environment for the student and provides novelty in education (Kaya & Dönmez, 2009). Liaw et al. (2008) stated that students have more opportunities to be in full control of their own learning and participation without limitation of knowledge levels.

This institute introduced a Learning Management System, Moodle, in 2006 to assist the learners in managing their own learning as well as to help the lecturers to facilitate learning in an online learning environment. In addition to Knutzen and Kennedy (2008), Moodle is a free and open source software that was developed around social constructivism pedagogy. However, the practice of this online medium is to transfer information from the lecturer to students. This is accomplished by providing students with access to information and expecting them to demonstrate their learning in an exam. There is an increasing need to develop a powerful online learning environment to support quality in the teaching and learning process and thus boost the participation of the students. The teaching and learning process is enhanced through manipulating the level of control teachers have over the learning activities in this environment (Lam, Au Yeung, & McNaught, 2007).

## **2. Method**

The study employed a quasi-nonequivalent (pre- and posttest) control group design to investigate the effectiveness of online peer learning.

### *2.1. Participants*

Two hundred and ninety-one students who were undertaking Statistics as a core subject in the January 2010 semester of the institute were involved in the study. Students were randomly assigned to the control or experimental group. The experimental group comprised matriculation students who received online peer learning as a supplement to face-to-face instruction, while the control group comprised matriculation students who received only face-to-face instruction.

## 2.2. Procedure

The students were given an hour to complete a pretest that consisted of 35 multiple-choice questions before the study. The researcher introduced the syllabus, structure of the program, compilation of the teaching materials and tutorials, and online discussion forum. The participants in the experimental group were asked to group themselves in a group of five persons for the study. Ben-Zvi and Garfield (2008) suggested that smaller groups are more successful than larger groups, especially when the time duration is low. The participants were encouraged to comment on the step-by-step solution, answers provided, and tidiness of the work posted by their peers. The posttest was administered after eight weeks of the study. The participants were given one hour to complete the posttest. Questionnaires were distributed to the participants after the posttest.

## 2.3. Instruments

The pre- and posttests were constructed according to the requirements of the Statistics syllabus. The researcher used the same pre- and posttest to ensure the reliability of the test in terms of format, content, and cognitive levels. The test consisted of 35 multiple-choice questions to measure student academic achievement. The draft of the pre- and posttests was reviewed and validated by a panel of experts consisting of three experienced subject matter experts. A pilot test was conducted with 67 students of the May 2009 semester, where feedback comprised the test, the time needed to complete it, its format, its readability, and questions and concerns regarding it. The mean scores of the pre- and posttest were evaluated with the *t*-test; a parametric statistical test used to examine the difference between the means of these two samples (Fraenkel & Wallen, 2008).

The purpose of the questionnaire was to gain information concerning the participants' demographic data and the levels of motivation among students (Moreno, 2009). The researcher adopted the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia, & McKeachie, 1991) to measure the levels of motivation. A six-point Likert scale with a bipolar format was used to avoid students' selection of a totally neutral position for many items. Jeffrey (2009) suggested that the bipolar format indicated good reliability for all scales. The questionnaire was reviewed and validated by a panel of experts consisting of an experienced head of department, an instructional designer, language experts, and a psychology expert. The internal consistency estimate of reliability for the questionnaire using Cronbach's alpha with 67 students from the pilot tests was .892 for MSLQ.

## 2.4. Data Analysis

Pearson chi-square analysis was utilised to examine the equivalence between the experimental and control groups. The researcher further investigated the effectiveness of the online peer learning using *t*-test analysis. The alpha was set at 0.05 for all statistical tests.

## 3. Results

Of the 291 students, only 193 completed all the requirements. Of these 193 students, 109 (56.5%) and 84 (43.5%) were in the control group and experimental group respectively. According to Hill (2009), the nonequivalent control group was not controlled by researcher as the assignment of the participants to groups was through the mechanism of random assignment.

The average age of these 193 students was 18.96 years,  $SD = .883$ . The age range of the participants was between 17 and 24 years. The independent samples *t*-test demonstrated no significant difference between the age of the participants in the control group ( $M = 19.02$ ,  $SD = 1.018$ ) and the experimental group ( $M = 18.88$ ,  $SD = .666$ ). Pearson chi-square analyses demonstrated no significant difference between the two groups for gender, nationality, repeating the subject, possession of a laptop, possession of a personal computer, number of years as an internet user, and familiarity with e-learning. Therefore, the two groups were assumed to be equivalent with regard to their demographic composition.

### 3.1. Online Peer Learning and Academic Achievement

The first research question examined the differences in academic achievement between matriculation students who received face-to-face instruction and matriculation students who received online peer learning as a supplement to the face-to-face instruction. Table 1 shows the comparison of the mean of pre- and posttest between participants of control and experimental groups by using an independent sample *t*-test.

The pretest scores revealed that there was no significant difference in pretest scores for the control group. Therefore, the control and experimental groups were comparable. The posttest scores revealed a statistical significance for both the control and experimental groups. The results demonstrated that the experimental group's academic achievement was higher, although both groups had shown improvement. Athaus (1997), as cited in Hulsizer and Woolf (2009), found that the students who took part in face-to-face discussions in class as well as computer-mediated discussion groups were more likely to earn higher grades than those students who only participated in classroom discussions. The findings of this study add to the large volume of findings on the effectiveness of online peer learning in academic achievement (Boud, 2001; Fisher & Baird, 2005; Daniels, 2008).

Table 1. Comparison of the mean of pre- and posttest between participants of experimental and control group by the independent samples *t*-test

	Control Group		Experimental Group		<i>t</i>	Sig.
	M	SD	M	SD		
Pretest	11.50	3.723	11.49	2.792	.35	p = .972
Posttest	20.15	4.768	22.35	4.527	-3.246	p = .001

### 3.2. Online Peer Learning and Motivation

The second research question focused on the motivational levels of the control and experimental groups. Table 2 reveals the comparison of the mean MSLQ scores of the participants of the control and experimental groups by the independent samples *t*-test. The independent samples *t*-test was used to examine whether there was a significant difference between the control and experimental groups in terms of their motivational levels, based on the scores they obtained from the questionnaire. The mean score of motivational levels for the experimental group is greater than that for the control group. Effect size (Cohen's *d*) for the motivation mean differences between the control and experimental groups is -0.30. Therefore, the motivational level for the matriculation students who received online peer learning as a supplement to the face-to-face instruction was higher compared to that of the matriculation students who received face-to-face instruction. This finding is consistent with our understanding of social constructivism by Vygotsky (1978) in that we expect the students' motivation levels to be significantly higher for courses that embed online peer learning in traditional learning (Daniels, 2008; Hulsizer & Woolf, 2009).

Table 2. Comparison of the mean MSLQ scores between participants of experimental and control groups by the independent samples *t*-test.

	Control Group		Experimental Group		<i>t</i>	Sig.
	M	SD	M	SD		
Motivation	4.37	.56	4.53	.50	-2.049	p = .042

## 4. Recommendations

Future studies can incorporate a mixed method to study how online peer learning could impact the learners. The participants of this study were randomly assigned to the groups. Therefore, it was unlikely to manipulate the heterogeneity of the members to maximize the likelihood of meaningful and rich interactions (Webb & Palincsar, 1996, as cited in Moreno, 2009) as suggested by the cooperative learning (Moreno, 2009). Considering the time frame for the study, the eight sessions were sufficient due to the timeliness of the completion of this study. A proposal of at least a full semester of online peer learning curriculum for matriculation students is suggested for future studies. Allowing more time for the students to collaborate with peers is another criterion worth exploring in future studies.

## 5. Conclusion

The study found that matriculation students' academic achievement and motivation were significantly different between the control and experimental groups. Besides improving students' academic achievement and motivation, a learning environment that can facilitate sharing of knowledge is vital. Therefore, the results suggest that online peer learning facilitates academic achievement and motivation of the learners.

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