The Effect of Peer Learning on Students' Attitude toward Mathematics

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Joseph B. Campit[1], Rodelio M. Garin[2]
Pangasinan State University – Bayambang Campus, Philippines
[1]*josephbcampit@gmail.com*, [2]*rodgarin36@gmail.com*

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Abstract - *This study sought to investigate the effect of peer learning on attitude toward mathematics of the second year college students at the Pangasinan State University - Bayambang Campus. More specifically, it attempted to determine and compare the attitude toward mathematics of the students before and after their exposure to peer learning and conventional teaching strategy. The experimental method of research was used in the study particularly the pretest-posttest control group design. Valid and reliable researcher-made attitudinal scale was the data gathering instrument. Weighted mean, Mann Whitney U test, and Wilcoxon Signed Rank test were the statistical tools used in analyzing and interpreting the research data. The findings revealed that the students in the peer learning group had a significant change in their attitude after their exposure to the peer learning strategy which was not observed among those students in the conventional teaching group. Based on the findings, it is concluded that the students' attitude toward mathematics was improved when exposed to peer learning strategy. It is recommended that peer learning strategy should be used by mathematics teacher in order to improve the attitude toward mathematics of the students. Furthermore, further studies should be conducted to find out the effects of peer learning in other subject areas or other group of respondents or another peer grouping.*

Keywords: *attitude, peer learning, tutoring, proctoring, cooperative learning, mentoring*

INTRODUCTION

Affective behaviors are very vital in the process of learning mathematics because it is seen by the students as difficult, complex and boring subject [6]. Role of attitudes toward a mathematics is very big in whether students succeed or fail because students learn more when they are interested in what they learn and also they attain better if they like what they learn. Researchers contend that the changes in behavior can be easily developed if students have a positive attitude toward the subject [3]. Several research studies have shown a positive association between mathematics achievement of student and their attitude toward mathematics [10], [5].

According to Aiken [1], attitude toward mathematics is defined as "it is total of whether a person like mathematics or not, attitude to engage in mathematical activities or avoid them, person's belief for him to be good or bad in mathematics and his belief in whether mathematics shall be benefit or not". Similarly, Ma.X and Kishor [11] provide a broader definition of attitude toward mathematics as "an aggregated measure of liking or disliking of mathematics, probability to engage in or avoid mathematical task, belief that one is good or bad at mathematics, and belief that mathematics is useful or useless."

Peer learning is becoming an increasingly important part of mathematics courses and it is being use to improve the attitude toward mathematics in many countries [12]. Peer learning is an instructional strategy that consists of pairing learners of the same or differing ability together to learn an academic task [14]. Moreover, Goodlad and Hirst [9] defines peer learning as "when one learner teaches another learner and learn by teaching".

Many researches suggests that incorporating peer learning into the classroom offers numerous rewards. The socialization involvements occur during peer learning session can benefit both the tutors and tutees by motivating learners to learn [8] and increasing social standing among their peers [13]. The peer interaction has positive influence on attitude toward mathematics [15] and academic motivation [10].

This study aimed to determine the effect of peer learning on the attitude toward mathematics of the second year BSICT students. Specifically, the study sought to answer the following questions: 1) What is the attitude toward mathematics of the students before and after their exposure to peer learning, and conventional teaching? 2) Is there a significant difference between attitude toward mathematics of the

students exposed to peer learning and conventional teaching? 3) Is there significant difference in the attitude toward mathematics of the students before and after their exposure to the learning strategy?

METHODS

Research Design

The pretest-posttest control group experimental design was adopted for the research. According to Ariola [2], this design involves two groups of which are formed by random assignment.

In this study, two groups were used - one for the control group and the other one for the experimental group – and this was done by random assignment. After the experiment, the attitudinal scale was administered to measure the students' attitude toward mathematics. The result of this test was the basis for describing and comparing their attitude.

Subjects of the Study

The second year BSICT students of section 1 and section 2 enrolled in Discrete Structures during the 2nd semester of the school year 2013-2014 composed of 30 students each were used in this study. The subjects were not aware that the experiment is taking place to make the classroom activities be as normal or possible, thus eliminating the effect of some extra factors that would affect the result of the experiment.

The assignment to a strategy was done by tossing a coin. BSICT II-1 was labeled as tail and BSICT II-2 as head. The predominantly occurring side in a rule of 5 was assigned to the control group. Hence, the BSICT 1-1 students were assigned to peer learning while the BSICT II-2 students to conventional teaching.

Instrument

The Likert – type attitudinal scale used to assess the attitude of students toward mathematics was the main data gathering instrument used in this study.

Procedure

The experiment was conducted for six weeks during the regular schedule of the students in Discrete Structures, that is three times a week (Monday, Wednesday, Friday) one hour per meeting.

To control the time element of the study the following schedule was used. For the first three weeks conventional teaching was held from 8:00 – 9:00 in the morning and peer learning was from 1:00 – 2:00 in. On the 4th to 6th weeks, their schedule was interchanged. This was possible because both groups were available on such periods, being their vacant period.

The experimental group used the same instructional materials and underwent the same instructional process except in the fixing skills. The two groups have the same exposure from review to development of the lesson. In fixing skills, however, the students in peer learning group solved exercises by pair with a peer and they are free to discuss by themselves. In conventional group, the teacher as usual, continued his discussion. As the students answered the exercises individually, the teacher goes around to monitor their work.

In the peer learning group, the students worked by pair in the fixing skills portion of the lesson. The pairing was done at random by drawing of lots. Each student wrote his name on a piece of paper then rolled and put it in a box. Then the teacher drew two rolled paper at a time. This composed a pair. The same process was done until all the rolled papers had been drawn.

The conduct of the experiment is summarized as follows:

Conventional Strategy	**Peer Learning Strategy**
1. Review	1. Review
2. Motivation	2. Motivation
3. Development of the lesson	3. Development of the lesson
4. Fixing Skills (Teacher goes around while students answer the exercises individually)	4. Fixing Skills (Students work by pair)
5. Evaluation	5. Evaluation

Statistical Treatment of data

The following statistical tools were used in the study. Weighted mean was used to determine the students' attitude toward mathematics and interpreted using the following scale: 2.34 – 3.00: Always/ Favorable; 1.67 – 2.33: Sometimes/ Moderate; 1.00 – 1.66: Never/Unfavorable.

Mann Whitney U Test was used to determine if there is significant difference between the attitude of the students exposed to peer learning and conventional teaching strategy. Wilcoxon Signed Ranks was used to determine if there is significant difference in the attitude of the students before and after their exposure to the learning strategy.

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RESULTS AND DISCUSSION

Table 1. Attitude toward Mathematics of the Students Before and After Their Exposure to Peer Learning

No	Statement	Before		After	
		WM	Response	WM	Response
1	I find mathematics to be challenging.	2.639	Always	2.778	Always
2	I work hard to learn mathematics	2.250	Sometimes	2.944	Always
3	I enjoy studying mathematics.	2.222	Sometimes	2.278	Sometimes
4	I find mathematics to be very interesting.	2.194	Sometimes	2.361	Sometimes
5	I prepare myself carefully for exams in mathematics	2.167	Sometimes	2.778	Always
6	I get good scores in mathematics	2.083	Sometimes	2.167	Sometimes
7	I feel a positive definite reaction to mathematics.	2.000	Sometimes	2.778	Always
8	I learn mathematics with "gusto".	1.944	Sometimes	2.306	Sometimes
9	I know I can do well in mathematics.	1.944	Sometimes	2.278	Sometimes
10	I feel secured in my mathematics class.	1.944	Sometimes	2.222	Sometimes
11	I feel at ease in my mathematics subject.	1.806	Sometimes	2.194	Sometimes
12	I am happier in my mathematics class than in any other subjects.	1.806	Sometimes	2.139	Sometimes
13	I can handle more difficult mathematics problems.	1.750	Sometimes	1.944	Sometimes
14	I am willing to take more than the required unit of mathematics in general education.	1.639	Never	1.750	Sometimes
15	I am able to solve problems in mathematics without too much difficulty.	1.639	Never	2.111	Sometimes
	Overall	**2.002**	**Moderate**	**2.352**	**Favorable**

Table 2. Attitude toward Mathematics of the Students Before and After their Exposure to Conventional Teaching

No	Statement	Before		After	
		WM	Response	WM	Response
1	I find mathematics to be challenging.	2.528	Always	2.667	Always
2	I work hard to learn mathematics	2.417	Always	2.556	Always
3	I prepare myself carefully for exams in mathematics	2.306	Sometimes	2.333	Sometimes
4	I find mathematics to be very interesting.	2.25	Sometimes	2.305	Sometimes
5	I enjoy studying mathematics.	2.222	Sometimes	2.305	Sometimes
6	I feel a positive definite reaction to mathematics.	2.222	Sometimes	2.278	Sometimes
7	I feel secured in my mathematics class.	2.194	Sometimes	2.056	Sometimes
8	I know I can do well in mathematics.	2.111	Sometimes	2.222	Sometimes
9	I get good scores in mathematics	2.111	Sometimes	2.083	Sometimes
10	I feel at ease in my mathematics subject.	2.056	Sometimes	2.028	Sometimes
11	I learn mathematics with "gusto".	2.056	Sometimes	2.194	Sometimes
12	I am happier in my mathematics class than in any other subjects.	2	Sometimes	2.194	Sometimes
13	I am able to solve problems in mathematics without too much difficulty.	1.944	Sometimes	1.944	Sometimes
14	I am willing to take more than the required unit of mathematics in general education.	1.944	Sometimes	1.917	Sometimes
15	I can handle more difficult mathematics problems.	1.889	Sometimes	1.777	Sometimes
	Overall	**2.150**	**Moderate**	**2.190**	**Moderate**

The attitude toward mathematics of the students before and after their exposure to the teaching strategy was computed using the average weighted mean. Table 1 presents the attitude toward mathematics of students before and after their exposure to peer learning.

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The students exposed to peer learning had **moderate** attitude before their exposure to the strategy as indicated by the overall weighted mean of 2.002. Among the 15 statements, they responded **always** in only one item that is, they always find mathematics to be challenging. On the other hand, two items were rated never. They **neve**r solved problems in mathematics without too much difficulty and were **never** willing to take more than the required units of mathematics in general education as revealed by their weighted means of 1.639 each.

After the students' exposure to peer learning, they had a favorable attitude toward mathematics as revealed by the weighted mean of 2.352. This time, however, out of the 15 statements, they responded **always** in four items, namely: feeling a positive definite reaction toward mathematics (2.778), finding mathematics to be challenging (2.778), preparing themselves carefully for exams in mathematics (2.778) and working hard to learn mathematics (2.944). All the rest were rated **sometimes**. No item was rated **never** after exposed to peer learning. This implies that the attitude of students after their exposure to peer learning strategy had improved.

Table 2 presents the attitude toward mathematics of the students before and after their exposure to conventional teaching. Table 2 reveals that the students had a moderate attitude toward mathematics before their exposure to conventional teaching based on the overall weighted mean of 2.150. Two (2) out of fifteen (15) items were responded always. They **always** find mathematics to be challenging and **always** work hard to learn mathematics as shown by the weighted means of 2.528 and 2.417, respectively. All the remaining attitudinal statements were answered **sometimes**.

The table further shows that after the experiment, they had **moderate** attitude toward mathematics as indicated by the overall weighted mean of 2.190 which is the same attitude before the experiment. The same two (2) items out of fifteen (15) statements were answered **always**. These are "I find mathematics to be challenging" with a weighted mean of 2.667, and "I work hard to learn mathematics" with a weighted mean of 2.556. All the remaining attitudinal statements are answered **sometimes**. This implies that the attitude of students after their exposure to conventional teaching strategy did not changed.

Table 3 presents the summary of Mann Whitney U Test to determine if there is a significant difference between the attitude toward mathematics of the students exposed to the different strategy. It can be gleaned from Table 3 that the computed z = -1.712 has a p-value of .087 which is greater than .05 level of alpha.

Table 3. Test of Difference between the Attitude toward Mathematics of Students Before Exposure to Peer Learning and Conventional Teaching

Attitude	Mean Ranks	Sum of Ranks	Z	p-value
Peer Learning	40.71	1465.50	-1.712	.087
Conventional Teaching	32.29	1162.50		

This indicates that the null hypothesis which states that there is no significant difference between the attitude toward mathematics of the students before their exposure to peer learning and conventional teaching strategy is accepted. This means that there is no significant difference between the attitude of the students before their exposure to peer learning and conventional teaching strategy. This implies that students in the peer learning and conventional teaching strategy had comparable attitude before their exposure to the learning strategy.

Table 4. Test of Difference between the Attitude toward Mathematics of Students After Exposure to Peer Learning and Conventional Teaching

Attitude	Mean Ranks	Sum of Ranks	Z	p-value
Peer Learning	44.92	1617.00	-3.432*	.001
Conventional Teaching	28.08	1011.00		

** Significant at .05 level of alpha*

Table 4 presents the summary of Mann Whitney U test after students' exposure to peer learning and conventional teaching strategy. Table 4 reveals that computed Z=-3.432 has p-value of .001. Since the p-value is lower than .05 level of alpha then the null hypothesis which states that there is no significant difference between the attitude of students after their exposure to peer learning and conventional teaching strategy is rejected. This means that the attitude of students differed significantly after their exposure to peer learning and conventional teaching strategy. This implies that students in the peer learning group had significantly favorable attitude compared to the conventional teaching group after their exposure to the strategy. Thus, peer learning is more effective strategy in improving students' attitude toward mathematics compared to conventional method of teaching. This

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could be attributed to the fact that learning with their peers is a non-threatening interactive learning involvement that motivates them to learn and free to express their ideas. According to Steinburg, Dornbusch, and Brown [15], working in pair or collaboratively have a positive influence on students' attitude toward mathematics.

Table 5. Test of Difference in the Attitude toward Mathematics of the Students before and after their Exposure to Peer Learning

Attitude	Ranks	Sum of Ranks	Z	p-value
Attitude After - Attitude Before	Negative Ranks	59.50	-4.079*	.000
	Positive Ranks	535.50		

** Significant at .05 level of alpha*

Table 5 presents the summary of Wilcoxon Signed Ranks Test to determine the significant difference in the attitude toward mathematics of the students before and after their exposure to the peer learning strategy. Table 5 for the peer learning group shows that the computed z = -4.079 has a p-value of .000. This indicates that the null hypothesis which states that there is no significant difference between the attitude toward mathematics of the students before and after their exposure to peer learning strategy is rejected. This means that the attitude of the students after exposure to peer learning is better than before their exposure. This implies that the attitude of the students had significantly changed after their exposure to peer learning strategy. Thus, working with their peers made them realized that mathematics is not that difficult. Through discussion and interaction with their peers, they are able to get immediate feedback from one whom they are comfortable to work with.

According to Capar and Tarim [4], through peer interaction, students learn positive attitude and values. Cohen and Kulik [6] also say that the effect of peer learning to both tutor and tutee is positive in the improvement of attitude toward the subject matter.

Table 6. Test of Difference in the Attitude toward Mathematics of the Students before and after their Exposure to Conventional Teaching

Attitude	Ranks	Sum of Ranks	Z	p-value
Attitude After – Attitude Before	Negative Ranks	118.50	-2.726	.06
	Positive Ranks	409.50		

Table 6 presents the summary of Wilcoxon Signed Ranks Test to determine the significant difference between the attitude toward mathematics of the students before and after their exposure to the conventional teaching strategy. As shown in Table 6 for conventional teaching group, the computed z = -2.726 has a significance of .06. This indicates that the null hypothesis which states that there is no significant difference between the attitude toward mathematics of students before and after their exposure conventional teaching strategy is accepted. This means that the attitude of students toward mathematics exposed to conventional teaching strategy remained the same even after exposure to the strategy.

Based on the findings, it can be claimed that the attitude toward the subject before and after exposure to conventional teaching is comparable. This is probably due to the fact that they have been used to the strategy that no amount of motivation or if there is, it did not warrant a change in their attitude toward the subject.

Summary of Findings

The overall weighted mean of the attitude toward mathematics of the students exposed to peer learning before the experiment was 2.002 while 2.351 after the experiment. On the other hand, the overall weighted mean of the attitude toward mathematics of the students exposed to conventional teaching before the experiment is 2.150 and 2.1904 after the experiment. There is no significant difference between the attitude of the students before their exposure to peer learning and conventional teaching strategy as indicated by z = -1.712 with a p-value of .087. There is significant difference between the attitude of students after their exposure to peer learning and conventional teaching strategy as revealed by the Z=-3.432 with a p-value of .001. There is significant difference in the attitude of the students before and after exposure to peer learning strategy as shown by the computed z of -4.079 with significance value of .000. There is no significant difference in the attitude of the students before and after exposure to conventional teaching strategy as supported by the z-value of -2.726 and a significance of .06.

CONCLUSION AND RECOMMENDATION

Students in the peer learning group and conventional teaching group had the same attitude before their exposure to the strategy. Students in the peer learning group had significantly favorable attitude than students in the conventional teaching

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group after their exposure to the strategy. The attitudes of students toward the subject exposed to the peer learning strategy had significant improvement after exposure to the strategy, while the attitudes of those exposed to conventional teaching strategy did not improve after exposure. Peer learning is an effective teaching strategy in improving students' attitude toward mathematics.

The peer learning strategy should be used by mathematics teachers in order to improve their attitude toward mathematics. Further studies should be conducted to find out the effects of peer learning on other subject areas or other group of respondents or another peer grouping.

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