

The Effect of Peer Teaching on Mathematics Academic Achievement of the Undergraduate Students in Oman

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Abstract

This study explored the effects of peer teaching on mathematics academic achievement of the undergraduate students in Oman. The sample of this study composed of (32) undergraduate female students enrolled in the course, "Mathematics for Social Sciences I" in Mathematics and Sciences Unit in Dhofar University in spring semester 2014-2015. The sample of the study was divided randomly into two groups, the first group was selected as experimental group (16) students and the other group was selected as control group (16) students. Both groups studied the same curriculum, same materials, and both groups had been taught by the same instructor. Data were collected by using, Mathematics Achievement Test (MACT) which was prepared by the researchers. In order to analyze data, researchers used mean, standard deviations, and Analysis of t-test. The result of the study found that peer teaching strategy is an active tool to increase the mathematical achievement. The study recommended the instructors and college professors to use peer teaching in order to improve the performance of the students in mathematics.

Keywords: peer teaching, academic achievement

1. Introduction and Background

Mathematics is important in our daily life. It is the tool and language of almost all fields of science. It helps us recognize patterns and understand the world around us. Many students in elementary, high school and even at the university level find that mathematics is difficult and challenge because it is an abstract discipline. Therefore, mathematics instructors try to create a math-friendly environment to help their students meet this challenge. One way to achieve this is by giving students an opportunity to learn and study collaboratively. For example, students can work together in groups.

Vygotsky (1978) suggested that in order for learning to take place, people should talk and interact with each other. People naturally learn from each other and work cooperatively in their everyday lives. Vygotsky viewed cooperative learning approach as important part of a process which leads to the social construction of knowledge.

Christison (1990) considered cooperative learning as a good strategy to increase the attention and motivation of the student. Oslen and Kagan (1992) reported cooperative learning as an activity which depends on the social interaction and exchange of information between students working in groups and each student is accountable for his own learning.

Actually, peer interaction can have a great impact on academic achievement and motivation as well (Light & Littleton, 1999; Steinburg, Dornbusch, & Brown, 1992; Wentzel, 1999). Many researches showed that the socialization process which takes place during the peer teaching is useful and helpful for both, tutor and tutee. It increases the motivation of the students to learn and in the same time the social standing among peers will be much better (D. Fuchs, L. S. Fuchs, Mathes, & Martiniez, 2002; Rohrbeck et al., 2003; S. Miller & P. Miller, 1995).

Peer teaching is a subset of cooperative learning. Atieh (1999) defined peer teaching as teaching system in which learners cooperate with each other. One of them (peer teacher) conveys knowledge and skills that he has mastered to other students (peer learner) under the supervision of the teacher. Darwaza (2000) reported that peer teaching is an interactive approach including two students. One of them takes the role of the teacher and the

other takes the role of the learner.

Saif (2004) considered peer teaching as a mutual learning process in which students teach others the desired skills and knowledge with full coordination with their teacher in case there are any comments or questions. However, the teacher should be around always to solve immediately any problems may arise between students.

Researches show that peer teaching is useful and has many benefits for students and teachers. Vasay (2010) reported that peer teaching is helpful for fast learners and slow learners as well. It helps fast learners to master the concepts related to the course and confidently express their ideas. Slow learners improve and develop their performance and get a better understanding of the terms of the lessons. Peer teaching helps both, fast learners and slow learners in developing important values such as sharing, self-esteem, and self-discipline.

Lord (2001) reported that students working in groups perform better on exams especially questions that involve reasoning and critical thinking skills. Actually; peer teaching, a type of collaborative learning, often happens spontaneously with a group of students. In fact, educators have found through experience and their research that peer teaching is an effective strategy in helping learners achieve the educational goals.

Al Deeb (2006), states that peer teaching is one of the most effective strategies in the teaching and learning process because it deals with the social as well as the academic side of learning by creating a comfortable environment for teaching and learning.

Although the name 'peer teaching' sounds straight forward, it is in fact a complex process by which a student learns from another student who has more experience and knowledge. Afaneh (2007) considered peer teaching as communication between an excellent student, who is doing very well or who recently completed the course successfully, and another student encountering difficulties in the same course.

1.1 Research Problem

Mathematics for The Arts is an important course in Math Department. It is a compulsory course for Business students and one of the elective courses for Arts students (Education, Social Sciences, and Languages).

The performance of the students in this course is consistently weak and the percent of the failures is always high. The researcher discussed this problem with some Mathematics professors in the department and also with Learning Support Center (LSC) director. Many ideas and suggestions were discussed in order to help the students.

One of the strategies discussed was peer teaching strategy. It was reported by the director of LSC that some weak students (not all students) who received assistance from their peers showed significant improvement. A discussion was held about the category of the students who may get benefit from peer teaching strategy.

Failures students were divided into three levels or three categories. The first category included students who scored in the midterm exam (which is out of 20) from 0-20%. The second category included students who scored in the midterm exam between 20%-40% and the third category included students who scored in the midterm exam between 40%-60% (passing percent is 60% not 50%). The professors, LSC director, and the researchers agreed that the best category which may get benefit from the peer teaching strategy is the third category (40%-60%). The study therefore aimed to find out the effect of peer teaching on the academic achievement in mathematics of the undergraduate students in Oman.

1.2 Previous Studies

Hulya (2004) conducted a study aimed to explore the effectiveness of one of the interactive engage method, which is peer instruction enriched by concept test on students' achievement and attitude towards physics. He used two types of teaching: peer instruction enriched by concept test and traditional instruction. For the study, the researcher prepared two tools: Mathematics Achievement test and attitude test. Three teachers participated in the study in addition to 192 10th grade students. Multivariate Analysis of Covariance (MANCOVA) is used to analyze the data of the post-test. The statistical results indicated that peer instruction was more effective than traditional instruction. However, the study showed no differences in attitudes towards physics between the two groups.

Vasay (2010) held a study to find out the effect of the strategy of peer teaching on the student's performance in mathematics. The study consisted of two parts: Phase 1 and Phase 2. In the first phase, the researcher aimed to investigate the effect of peer teaching in developing the foundation of students in number, integers, decimals, and fractions. While in Phase 2 he measured the performance of students in college algebra. The study used pretest-posttest Control-Experimental group design. The data obtained by posttest was analyzed by t-test. The results showed that the experimental group was significantly better in their performance.

El-Sayed et al. (2013) conducted a study aimed to assess the effect of peer teaching in a nursing administration course on undergraduate nursing students' performance. The study used a quasi-experimental nonrandomized comparative design. The participants in the study consisted of two groups: control group and experimental group. Three tools were used for data collection: Student's Clinical Evaluation checklist, Clinical Teaching Preference Questionnaire, and Peer Teaching Experience Questionnaire. The findings of the study indicated that the performance of the nursing students who learned by peer teaching is significantly better than the performance of control group.

Mirzeoglu (2014) conducted a study aimed to examine the effect of peer teaching on the university students' achievement in cognitive, affective, psychomotor domains and game performance in volleyball courses. A quasi-experimental design was used in this study. The sample of the study composed of 24 females and 46 males. Volleyball achievement test, volleyball attitude scale, and volleyball skills observation forms have been used to collect data. The results of the study showed that using different instructional models improve students' achievement in cognitive, psychomotor domains and game performance.

1.3 Significance of the Study

This study will examine the importance of using qualified students to help college professors in teaching mathematics. When using the traditional approach of lecturing in math, or any scientific discipline, the students are nothing but passive tools in the learning process.

In most classes, the faculty member cannot pay enough attention to all students in the class so he or she needs assistance. This study will provide important information to educators about enhancing the teaching process by using the inexpensive strategy of peer teaching.

This study will contribute considerably to the psychological and educational research in the field of the pedagogy of college mathematics. If the outcome shows that peer tutoring is an effective way to assist math teachers, it will encourage faculty to take advantage of the mutual benefits that occur when students teach other.

Findings and recommendations of this study provide insight into how a group of Dhofar University students perceives themselves as mathematics learners. The results of the study can help instructors, administrators, and even policy makers who endeavor to develop the teaching- learning process and classroom environments.

1.4 Research Question

What is the effect of peer teaching on the academic achievement in Mathematics of the undergraduate students in Oman?

1.5 Research Hypothesis

There is no statistically significant difference at ($\alpha=0.05$) in mathematics academic achievement of the undergraduate students in Oman attributed to the peer teaching process.

1.6 Scope and Delimitations of the Study

This study started on 22nd of March 2015 and stopped on 14th of May 2015. This study involved two groups; experimental (16) students and control group (16) students.

The generalization of the findings of this study will be limited by:

- 1) A sample of undergraduate female students in Dhofar University.
- 2) Two chapters of Mathematics textbook of "Applied Mathematics for Business, Economics, and Social Sciences".
- 3) Using Student Learning Groups model of peer teaching.
- 4) The validity and reliability of the tools used to collect data.

2. Methodology

This section explains The study sample, Instrument, Design and variables, procedures, Operational definitions, and Statistical treatment.

2.1 The Study Sample

The participants of the study are female students enrolled in the course "Mathematics for The Arts". To insure that there is no effect of the instructor on the results of the study, all participants should be taught by the same instructor. To maximize the number of participants, we selected the instructor who had the largest number of sections. Dr. Sabir Siddiqui was the best choice because he had four sections with an average of 30 students in

each section. The total number was around 120 students. The result of the first exam showed that the percent of the failures of Dr. Sabir's students was around 46% or 55 students. Number of female failures which belonged to our category (8-12) was (32) students. The students were divided randomly into two groups, experimental group (16) students and control group (16) students.

The study sample composed of (32) undergraduate female students enrolled in a course, "Mathematics for Social Sciences I" in spring 2015-2015 semester in Dhofar University. All students belong to the third category who scored in the midterm exam between 8-12. Taking into account that midterm exam is out of 20.

2.2 Study Instrument: Mathematics Achievement Test (MACT)

Multiple Choices test was used to measure the students' achievement at the end of the study. The test covered the following topics: Characteristics of Linear Equations, Two variable system of equations, Functions and their Domains and Characteristics of Exponential Functions.

To check the validity, three Mathematics professors were asked to check the validity items. Their comments and notes were discussed and based on the discussion researchers made some changes. In order to calculate the degree of agreement, Researchers used Cooper equation and they found it (89%). Darwaza (1997) reported that the educational researches are accepted if the degree of agreement coefficients exceeded (75%).

In order to calculate reliability coefficient Corder-Richardson (K, R-20) equation was used and found (0.83). Finally, Mathematics Achievement test (MACT) composed of 10 problems. The maximum score of the test is (10), while the minimum is (0).

2.3 Study Design and Variables

2.3.1 Study Design

This study used the Pretest-Posttest Control-experimental group design using two groups of Dhofar University female students. The first group taught with peer teaching strategy while the other group taught without peer teaching.

Study Design

G1	X1	O1	O2
G2		O1	O2

G1: Group which was taught by peer teaching.

G2: Group which wasn't taught by peer teaching.

X1: Experimental manipulation for the 1st group.

O1: Pretest performance of students on the midterm exam.

O2: Posttest performance of students on (MACT).

2.3.2 Independent variable: Peer Teaching Method.

2.3.3 Dependent variable :Academic Achievement of Mathematics

2.4 Procedure

The following procedures were followed:

- Applying the first midterm and choosing all the female students of Dr. Saber's sections who scored between 8-12 (out of 20).
- Meeting with the girls, explaining the aim of the study, the nature of their participation, and getting their consent for participation in the study.
- Assigning the girls randomly into experimental and control groups.
- Starting the treatment which continues until the end of the semester.
- Applying the post-test at the end of the semester.

2.5 Operational Definitions

Two main terms involved in the study: Peer Teaching and Academic Achievement.

* Peer Teaching: A strategy by which student teaches other students that are weak and less experienced about a certain subject. Peer teaching can be applied in different approaches. Abu Shaban (2010) identified different types of peer teaching:

- Discussion groups: small groups guided by student teaching assistant. The groups are used to supplement large lectures. The student teaching assistant is selected among students who previously have done well in the course.
- One-to-one tutoring: One skillful student (peer teacher) and one student (peer learner) who is weak or less skillful.
- Student Learning Groups–In which students learn and work in self-guided groups to enhance peer learning.

The researchers followed the first approach in this study (Discussion groups). There was a female student teaching assistant who previously studied the course and scored >95 %. This student attended the classes of the experimental group. She was close to the students and whenever the instructor started the guided practice phase she was following up the students, explaining, giving hints, and even teaching whenever it is necessary.

* Academic Achievement: The level of actual accomplishment or proficiency one has achieved in an academic area, as opposed to one's potential in the educational goals. It was measured by student score in Mathematics Achievement Test (MACT) that was prepared by the researchers.

2.6 Statistical Treatment

In analyzing data, researchers used mean, standard deviations, and Analysis of t-test.

3. Results

3.1 Pre-Test

The midterm exam was used as pre- test in order to select the sample of the study. 32 participants were selected based on the results of the midterm exam. All of them belong to the third category (40%-60%). Table (1) shows the mean and standard deviation of the mid-term exam (pre-test). Referring to Table 1 the mean score of the experimental group is (10.34), while that of the control group is (10.16) out of a maximum possible score of 20.

Table 1. The means and standard deviations for the results of pre-test

	Group	N	Mean	Std. Deviation
Math Achievement	Experimental	16	10.34	1.33
	Control	16	10.16	1.21

To check if the difference in the means of the pre- test is statistically significant or not, an analysis of t-test has been associated. Table 2 explains the results.

Table 2. *T*-test Result Comparing Experimental and Control Groups on Mathematics Achievement Before Treatment

	Levene's Test for Equality of Variances	t-test for Equality of Means								
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Upper	Lower
Math_Ach	Equal variances assumed	.138	.713	.209	30	.836	.09375	.44888	-.82299	1.01049
	Equal variances not assumed			.209	29.726	.836	.09375	.44888	-.82335	1.01085

Table 2 shows that “there is no significant difference in the means of experimental group ($M=10.34$, $SD=1.33$) and the control group ($M=10.16$, $SD=1.21$) of the pretest; $t(30) = 0.209$, $p= 0.836$ ”. Based on this analysis the two groups (The experimental group and control group) are considered equivalent.

3.2 Post-Test

The purpose of the study is to investigate the effect of peer teaching on the academic achievement in Mathematics of the undergraduate students in Oman.

The main question of this study is: What is the effect of peer teaching on the academic achievement in Mathematics of the undergraduate students in Oman?

The following hypothesis emerged from this question:

There is no statistically significant difference at ($\alpha=0.05$) mathematics academic achievement of the undergraduate students in Oman attributed to the peer teaching strategy.

To answer this question, the means and standard deviations of the post-test (MACT) was obtained and explained in Table 3 below. The mean score of the experimental group is (6.6875), while that of the control group is (4.5000) out of a maximum possible score of 10.

Table 3. The means and standard deviations for the results of post-test

	Group	N	Mean	Std. Deviation	Std. Error Mean
Math_Ach	Experimental	16	6.69	1.96	.489
	Control	16	4.50	2.63	.658

To check if the difference in the means of the post- test is statistically significant or not, an analysis of t-test has been associated. Table 4 explains the results.

Table 4. *T*-test result comparing experimental and control groups on mathematics achievement after treatment

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Upper	Lower
Math_Ach	Equal variances assumed	1.858	.183	2.667	30	.012	2.18750	.82016	.51252	3.86248
	Equal variances not assumed			2.667	27.696	.013	2.18750	.82016	.50665	3.86835

Table 4 shows that “there is a significant difference in the means of the experimental group ($M=6.69$, $SD=1.96$) and the control group ($M=4.50$, $SD=2.63$) of the post- test; $t(30)=2.667$, $p=0.012$ ”.

Table 4 shows that there is a significant difference between the experimental group and control group in mathematics academic achievement in the post- test. The result means that the null hypothesis is rejected and accepting the alternative hypothesis, which states that: There is a significant statistical difference at ($\alpha=0.05$) in mathematics academic achievement of the undergraduate students in Oman attributed to the peer teaching strategy. The results suggest that peer teaching strategy has a positive effect on the academic achievement of mathematics.

4. Discussion

The main question of this study is: What is the effect of peer teaching on the academic achievement in Mathematics of the undergraduate students in Oman? The following hypothesis emerged from the question: There is no statistically significant difference at ($\alpha=0.05$) in mathematics academic achievement of the undergraduate students in Oman attributed to the peer teaching process.

The results in Table 4 showed that there is a statistical significance difference at a level ($\alpha = 0.05$) in mathematics academic achievement of the undergraduate students in Oman attributed to the peer teaching process.

The findings of this study can be attributed to the followings:

Students may feel more at ease when they deal with a peer tutor rather than their teacher or professor, which enable them to study better and concentrate more on the subject matter allowing for better understanding of the concepts, (Ehly & Stephen, 1980). Also, students spend more time in the learning process and there is a direct interaction in which the student is open and feels comfortable which foster the active learning. Actually, peer teaching improves the cognitive gain and social gain as well.

The findings of this study are in agreement with that of Dioso-Henson (2012) who compared the academic gains of college students enrolled in Physics using Reciprocal Peer Tutoring (RPT) with others using non-Reciprocal Peer Tutoring (non-RPT). The results showed that both types of peer tutoring produced significantly larger academic gains than traditional classroom instruction and RPT resulted in marginally larger academic gains than non-RPT. Also, the findings of this study are in agreement with a study conducted by Bowman-Perrott, Davis, Vannest, Williams, Greenwood, and Parker (2013), which examined the effects of peer tutoring across 26 single-case research experiments for 938 students in Grades 1-12 in a meta-analysis study. Findings suggested that peer tutoring is an effective intervention regardless of dosage, grade level, or disability status.

5. Recommendations

The current study shows that peer teaching is an active tool in improving the performance of the students in Mathematics at the college level. It is strongly recommended to study the efficiency of this strategy on other subjects or on the school level. In Oman or even on the Gulf States, small numbers of researches have been conducted to study the peer teaching strategy and its effect on several variables. The authors recommend the

researchers to study this strategy and explore its benefits on the students.

In the light of the findings, the study recommended the instructors and college professors to use peer teaching as a very good strategy to help students in increasing their achievement.

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