Academic Achievement in Mathematics through Peer Tutoring: An Empirical Evidence

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Abstract

The main objective of this study was to find out the effects of peer tutoring on academic achievement of secondary level students in mathematics. Pre-test, post-test control group design was used to conduct experiment. A group of 100 students from female school were taken as sample. A teacher made pre test was conducted to define experimental and control group. The sample students were divided randomly in to experimental and control group on the basis of their score in pre-test. Treatment of peer tutoring was given for eight weeks to experimental group and control group taught traditionally. Teacher made post test prepared from first three chapters of 10th class text book of Mathematics. After treatment post test conducted on both experimental and control group. Statistically significant difference found between the academic achievement of students of experimental and control group. It was concluded that peer tutoring found effective as an intervention for secondary level students in mathematics. It was concluded that peer tutoring benefited tutors (high achievers) and (low achievers) tutee both.

Key words: Peer tutoring, experiment, academic achievement, students

Introduction

The peer tutoring is an effective intervention for improvement of content knowledge, and understanding. Peer tutoring is found to be effective in improving students' grades, increasing knowledge of subject matter, developing students' engagement and improving students' behavior in the class room of Mathematics, reading, vocabulary, social studies and English. Scruggs, Mastropieri and Marshak (2012) defined peer tutoring as an instructional strategy in which students work in pair form to learn academic tasks in the class. Woolfolk (2010) explained the Piaget's and Vygosky's idea of social interaction that Peer-to-peer interaction motivates students to learn and social interaction causes learning. Siyepu (2013) stated that Vygotsky's idea of the Zone of Proximal Development provide theoretical ground for peer tutoring. Problem-solving with the help of peer having more ability than tutee

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permits children to enhance new areas of potential. Zone of Proximal Development (ZPD) means the difference between the performance of students in learning activity with and without help of tutor. Piaget and Vygosky focus on learning process instead of content, the learner creates own knowledge through different learning situations through active participation and engagement. The social constructivist view of learning focus the role of the students to produces learning (the tutor and tutee) through their zone of proximal development and instead of stimulus/response process students are actively participating in making learning through cognitive accommodation or absorption. Cheng and Ku (2009) suggested the use of peer tutoring for turning disadvantage of mixed-ability students with different attitude and weak social interaction classes into advantage. Maddalena (2002) pointed out that the mixed ability class rooms were common problem for our teacher to face. The teacher faced difficulty in deciding whether or not to address the weak students and leave the more intelligent learners unmotivated and bore or taking the risk of isolating the lower level students by paying attention to those who have prior knowledge.

All public sector schools of Khyber Pakhtunkhwa never sorted students according to their ability levels, attitude towards subject and social interaction of the students. Therefore, it is common practice to have students of mixed-ability, diverse attitude towards subject and poor social interaction in our class rooms at secondary level. The problem of having mixed ability students with poor social interaction in Mathematics classroom was found common problem in public sector schools in Khyber Pakhtunkhwa. This problem can be addressed by using peer tutoring in the classroom. In peer tutoring the student can help their academically weak classmates through individual attention for weak students. The research study was designed to examine the effects of peer tutoring as learning strategy on students having varying mental level on academic achievements in the subject of Mathematics at the secondary level in district Haripur. The objectives of the research study were:

1. To find out the effect of peer tutoring on academic achievement of students in the subject of mathematics after treatment of peer tutoring.
2. To compare the academic achievement of students with reference to the caliber (high achievers and low achievers) after using peer tutoring.

Following hypotheses were also designed in order to achieve the objectives of the study;

1. There is no significant difference in the academic achievement of experimental and control group before applying peer tutoring.
2. There is no significant difference in the academic achievement of experimental and control groups after applying peer tutoring.
3. There is no significant difference in the academic achievement of High achievers in experimental and control groups after applying peer tutoring.
4. There is no significant difference in the academic achievement of Low achievers in experimental and control groups after applying peer tutoring.

The research study may be significant for teacher training institutes, in order to develop the capacity of prospective in utilization of innovative teaching strategies like peer tutoring. The research study may be significant for teacher trainers in motivating young teachers to use peer tutoring in future to accommodate mixed ability students in their class rooms.

Review of Literature

Costantini (2015) mentioned that the peer tutoring is an effective intervention for improvement of content knowledge, and understanding. Class-wide Peer tutoring is found to be effective in improving students' grades, increasing knowledge of subject matter, developing students' engagement and improving students' behavior in the class room of Mathematics, reading, vocabulary, social studies and English. Scruggs, Mastropieri, and Marshak (2012) stated that the teacher can help students with diverse abilities to acquire

master skills and knowledge by using peer tutoring otherwise traditional teaching system cannot provide individual learning, attention and speed. Kiburis (2012) used Peer Tutoring in Peer Assisted Learning Strategy (PALS) format with some modification in 7th grade students of regular education in subject of Mathematics and found increased their post-test scores in mathematics as compare to pre-test scores. Topping, Miller, Thurston, McGavock and Conlin (2011) mentioned that there were more gains for students with low socioeconomic status than high socioeconomic status, more gains for average students and more gains for girls than boys. Bowman-Perrott (2009) concluded that it provides one-one coaching during implementation. The students learn through teaching and earn opportunity to correct their errors. Also the students achieve their academic goals and improve their social relations all together. Miller, Topping and Thurston (2010) pointed out the benefits for tutee during peer tutoring include effective learning, individual attention, free responding to his companion than teacher and friendship with peer. Also Peer tutoring is effective in achievement of learning outcomes and provides the learners an opportunity to enhance their social and behavioral abilities, including communicating, sharing and cooperating with each other in the classroom. Also it is effective to improve learner's self-esteem. There is another fact, the weak students were not an active participant of the class but the peer tutoring helped them to make active participants of the class. Also peer tutoring enhances their tendency to share their views with their peers which they cannot share with their teachers (Maheady & Gard, 2010).

Kourea, Cartledge and Musti Rao (2007) and Topping (2005) cited by Horvath (2011) reported the effectiveness of peer tutoring on academic achievement of the students. Peer tutoring helps teacher to engage all students of the class in learning activity according to their individual needs where he helps them at the spot. Also peer tutoring is very effective and helpful not only for low achievers or struggling students but also for gifted or high achievers. Loke and Chow (2007) pointed out another benefit of peer tutoring that it is

tutor's own help through the process of teaching to their companion. When student assists other student in teaching learning process, self satisfaction and self-confidence were increased. Topping (2008) found no difference in effectiveness of same age tutors and cross age tutors and reported higher academic achievement, improved peer relationship, improvement in personal and social development and enhanced motivation. All the learners with different backgrounds showed remarkable gain in their learning because of implementation of same-age and cross-age tutoring. Parsons, Croft, and Harrison (2009) concluded that students worked together in peer tutoring and got high self concept and contentment to increase their confidence, and achievement level. Mesler (2009) worked on third grade students of an urban high school both tutor and tutee improved their math skills and showed good test scores at the end indicating increased achievement level.

Research Methodology

The research study was structured on pre-test, post-test control group design. Students were randomly assigned to both groups on the basis of pre test score. In this type of selection each and every student has a chance of both experimental and control groups. The students studying in 10^{th} class of Government Girls Higher Secondary School Kot Najibullah district Haripur were formed population of the study and a group of 100 students were taken as sample of the research study. Before starting the experiment the researcher conducted pre-test for all sample students. The sample students were divided into experimental and control group randomly on the basis of pre-test scores to equate the groups. For this purpose the researcher arranged the result of the sample students in descending order. And assigned students one by one to both experimental and control group. Finally both experimental and control groups were containing fifty student each.

For pre-test researcher constructed 70 multiple choice questions having four options with one correct answer from the text book of 9^{th} class Mathematics and presented them to secondary school Mathematics teachers for

their validity opinion. The researcher also got opinion from subject specialist Mathematics to ensure the validity of the test. Changes were made in items to enhance the validity. Few items were changed in the light of expert's opinion to make final draft of pre-test containing fifty items. For post-test researcher constructed 68 multiple choice questions with four options having one correct answer from first three units including, i. Quadratic Equations, ii. Theory of Quadratic Equations, and iii. Variations, from text book of 10^{th} class Mathematics and presented them to secondary school Mathematics teachers for their validity opinion. The researcher also got opinion from subject specialists of Mathematics to ensure the validity of the test. In the light of expert opinion changes were made in items to enhance the validity of the test and selected fifty items for final draft of post-test.

In order to check the reliability of the test, pre-test was piloted on fifty students of 10^{th} class in Government high school (Boys) sector # 4 Khalabat town ship. The reliability was measured by using Pearson formula. The calculated value of reliability for Pre-test was 0.705. In order to check the reliability of the test, post-test was piloted on fifty students of 10^{th} class in Government high school (Boys) sector # 2 Khalabat town ship. The reliability was measured by using Pearson formula. The calculated value of reliability for Post-test was 0.784. The experiment was conducted for eight weeks. Before starting experiment the researcher divided the students of experimental group into high achievers and low achievers on the basis of pre-test score. The researcher arranged score of students in descending order and selected first twenty five as high achievers and remaining twenty five as low achievers. The researcher made pair of one high achiever (tutor) and one low achiever (tutee) randomly to conduct experiment. During experiment first three chapters of syllabus of mathematics for 10^{th} class were taught to both control and experimental groups. The researcher took the responsibility of teaching experimental group in the presence of their subject teacher to apply peer tutoring strategies in the classroom. The researcher used peer tutoring for

experimental group for forty minutes daily while Mathematics teacher taught control group by traditional method. The researcher explained the topic from the 10th class text book for Mathematics for first ten (10) minutes. Then researcher assigned task (questions) from exercises related to the topic to students of experimental group during implementation of intervention. The tutor solved and explained the question to tutee and asked to repeat it at the same. Tutee repeated the same. Tutor immediately gave feedback at the work of tutee, prompt the mistakes and corrected them. After correct response of the tutee, tutor solved next problem. In case of failure or incorrect response of tutee the tutor repeated the same practice. This practice continued for fifteen (15) minutes. During each session of treatment the tutor and tutee switches their role after fifteen (15) minutes. The tutee got the role of tutor and did the same work for next fifteen (15) minutes. At the end of the lesson teacher highlighted the performance of the pairs. The researcher collected data before starting the experiment and after the completion of experiment. The marks of the students in pre test were first set of data. The marks of the students in post-test were second set of data.

Results

Table 1: ***Comparing experimental and control groups (Girls in Pre-test)***

Category	N	Mean	SD	t-value	p
Experimental	50	18.68	6.19		
Control	50	18.70	6.11	-0.16*	0.99

Table 1 elaborated the mean score, standard deviation, t-value and significance (2- tailed). For N=50 the mean score of experimental group was 18.68 with SD 6.19 while mean of control group was 18.7 with SD 6.11 and the calculated value of t was -0.016 and p was 0.99. As p >0.05 therefore, difference was not found statistically significant among the groups.

Table 2: *Comparing Experimental and Control Group Girls in Post-test*

Category	N	Mean	SD	t-value	p
Experimental	50	28.94	5.87		
Control	50	18.62	5.07	9.43*	0.00

Table 2 elaborated the mean score, standard deviation, t-value and significance (2- tailed). For N=50 the mean score of experimental group was 28.94 with SD 5.87 while mean of control group was 18.62 with SD 5.07 and the calculated value of t was 9.43 and p was 0.00. As $p < 0.05$ therefore, difference was found statistically significant among the groups.

Table 3: ***Comparing high achievers of experimental and control group girls in Post-test***

Category	N	Mean	SD	t-value	p
Experimental	25	33.68	4.14		
Control	25	22.64	3.47	10.21*	0.00

Table 3 elaborated the mean score, standard deviation, t-value and significance (2- tailed). For N=25 the mean score of high achievers in experimental group girls was 33.68 with SD 4.14 while mean of high achievers in control group girls was 22.64 with SD 3.47 and the calculated value of t was 10.21 and p was 0.00. As $p < 0.05$ therefore, difference was found statistically significant among the groups.

Table 4: ***Comparing Low achievers of experimental and control group girls in Post-test***

Category	N	Mean	SD	t-value	p
Experimental	25	24.20	2.53		
Control	25	14.60	2.77	12.79*	0.00

Table 4 elaborated the mean score, standard deviation, t-value and significance (2- tailed). For N=25 the mean score of low achievers in experimental group girls was 24.20 with SD 2.53 while mean of low achievers in control group girls was 14.60 with SD 2.77 and the calculated value of t was 12.79 and p was 0.00. As $p <0.05$ therefore, difference was found statistically significant among the groups.

Discussion

Results showed that the peer tutoring made positive impacts on the students' achievement and improved the achievement level of the students of experimental group. The results of the study are aligned with the results of the

study by Kiburis, (2012). Treatment (Peer Tutoring) has a significant effect on achievement level of students in mathematics of high achiever students which is same as reported by Kourea, Cartledge and Musti Rao (2007) and Topping (2005). Peer tutoring enhanced the results of the students is similar as reported by Mesler (2009) and Topping (2008). Improved academic level of low achievers in experimental group commonly known as weak students of the class proved peer tutoring effective tool for teachers as Maheady and Gard, (2010) mentioned in their research.

Conclusion

The analysis of data highlighted statistically significant difference between the performance of both experimental and control group. Both groups were equal in caliber therefore difference in the performance is the result of treatment. Treatment (peer tutoring) made positive impact on students' achievement and improved the achievement level of experimental group. The analysis of the post-test results helped to conclude that peer tutoring is an effective intervention. The peer tutoring is helpful tool for teacher to accommodate students of diverse abilities. The significant difference in the results of high achievers in both experimental and control group provided a strong ground for conclusion that Peer tutoring is effective for high achiever students. Similarly the peer tutoring increased the scores of low achiever students of experimental group and motivated the researcher to conclude that peer tutoring is beneficial and effective for low achiever students.

Recommendations

Following recommendations were made on the basis of results and conclusions;

1. Use of peer tutoring strategy may be encouraged in schools.
2. Orientation about proper use of peer tutoring may be provided to all teachers of schools.
3. Use of peer tutoring in all subject in general and Mathematics in particular is recommended

4. Peer tutoring may be applied to different classes
5. Teacher training institutes may provide training of using different innovative teaching learning strategies like peer tutoring in pre-service training of teachers.
6. Peer tutoring may be applied in order to make learning environment of class conducive.

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