

THE EFFECT OF PARTICIPATORY TEACHING METHODS ON STUDENTS' ACHIEVEMENT IN MATHEMATICS AT THE MIDDLE SCHOOL LEVEL

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Abstract

The main purpose of the present research is to study the effect of participatory teaching methods on students' achievement in mathematics at the middle school level. This study was conducted with both quantitative and qualitative research methods. For quantitative research, an experimental study was used to study the effect of participatory teaching methods. The experimental design adopted in this study was a true experimental design, namely, posttest only control group design. For this study, (120) Grade Six students were selected from schools such as BEHS (4), Pazundaung and BEHS (1), Latha by simple random sampling method. These students were divided into two groups: control and experimental. Experimental group was treated with participatory teaching methods and control group was taught with formal instruction. After that, a posttest was administered to two groups. Independent samples *t*-test was used to test whether there was significant difference between these two groups. Examination of the means and *t*-test at BEHS (4), Pazundaung ($t = 9.036, p < .001$) and BEHS (1), Latha ($t = 17.428, p < .001$) indicated that students who were taught by using participatory teaching methods demonstrated significantly better than those who were taught with formal instruction. For qualitative research, students from the experimental group from two selected schools were given a questionnaire. It consists of (15) items five-point Likert-scale. The results showed that students expressed their willingness to learn in participatory teaching methods and they had positive attitude towards participatory teaching methods. Research findings proved that participatory teaching methods have positive contribution to the mathematics teaching at the middle school level.

Keywords: participatory teaching methods, achievement, mathematics

Introduction

Today, the whole world is changing fast and on the way of progress. One of the basics of a country's development depends on the education system. With education, individuals are able to increase their knowledge and skills, accept new manners and be able to survive in the society. A person cannot contribute to one's society without education, especially the knowledge of mathematics. The general aim of teaching mathematics is to enable students to develop in fundamental skills and solve mathematical problems in their daily lives.

As a mathematics teacher in this modern age, it is important to provide more opportunities for students to participate in teaching/learning process. Hence, students need more time to think, work independently, participate or exchange ideas with others. Also, there is a need for more engaging methods of instruction to boost students' participation and achievement in mathematics. Therefore, this paper aims to study the effect of participatory teaching methods on students' achievement in mathematics at the middle school level.

Statement of the Problem

According to Khin Zaw (2001), the aims of education can be summarized into three aspects. The first aim is to help the child to develop his personality. Secondly, it is to help the

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child to relate himself to the society in which he lives. Thirdly, it is to help those who are growing up to be active and creative forces in society. However, in current situation in Myanmar, the focus of standardized testing is grounded on achieving high scores. Teachers directly explain the facts and things in the textbook and only use formal instruction. Lack of students' participation in learning process actively is one of the problems of current mathematics classroom in Myanmar.

Purposes of the Study

The main purpose of this paper is to study the effect of participatory teaching methods on students' achievement in mathematics at the middle school level. The specific purposes are as follows:

- To compare mathematics achievement between students who are taught by using participatory teaching methods and those who are not taught,
- To study students' attitude towards participatory teaching methods, and
- To make suggestions for the improvement of mathematics teaching and learning at the middle school level.

Research Hypotheses

The hypotheses of this study are as follows:

- There is a significant difference in mathematics achievement between Grade Six students who receive participatory teaching methods and who do not receive.
- There is a significant difference in mathematics achievement between experimental group and control group in performing knowledge level questions.
- There is a significant difference in mathematics achievement between experimental group and control group in performing comprehension level questions.
- There is a significant difference in mathematics achievement between experimental group and control group in performing application level questions.
- Students who are taught with participatory teaching methods will have positive attitude towards participatory teaching methods.

Scope of the Study

The following points indicate the scope of the study.

- This study is geographically restricted to Yangon Region.
- Participants in this study are (120) Grade Six students from the selected schools of the two Districts: No. (4), Basic Education High School, Pazundaung and No. (1), Basic Education High School, Latha within academic year (2018-2019).
- This study is limited content areas from Grade Six mathematics textbook volume I and II prescribed by Basic Education Curriculum, Syllabus and Textbook Committee (2018-2019).
- There are many methods in participatory teaching methods. This study is limited to three methods: group discussion, project method and discovery learning.

Definition of Key Terms

Participatory Teaching Methods

Participatory teaching methods are those which draw the students into the classroom learning process (Jones, 1987).

Achievement

Accomplishment of proficiency of performance in a given skills or body of knowledge (Good, 1959).

Mathematics

The gateway and key to all sciences (Bacon, n. d., cited in Zubair, 2012).

Significance of the Study

People have to know about the 21st century skills and need to improve them in today's children. Without these skills, children will not be able to successfully participate in the global economy. Teaching styles need to shift from teacher-centered teaching approach to child-centered approach. The roles of students who receive teacher-directed instruction are to listen, wait, take tests and do seatwork. The needs of students will not be filled. Unlike this, children are needed to be active and interested in learning process which allows them to participate freely.

To meet the challenges of the 21st century, teachers should provide the classrooms which welcome students to participate more than the past in the education process. Similarly, mathematics is essential for the development of education system because it relies on logic. Certain qualities are nurtured by mathematical thinking skills such as reasoning and critical thinking skills. Thus, mathematics, a valuable and essential subject, should not be taught with formal teaching styles. It should be taught with effective teaching methods which can promote students' attitude towards mathematics and mathematical skills. Hence, the paper will seek to reveal the effect of participatory teaching methods on students' achievement in mathematics at the middle school level.

Review of Related Literature

Participatory Teaching Methods

The essence of participatory teaching methods is to let students participate in classroom tasks instead of acting as a passive bystander role and to allow students to truly experience. Due to Suffolk (2004), effective teaching can be achieved only when participatory teaching methods are applied in the classroom. Participatory teaching methods compel teachers to create learning environments which give a room for students to discover by themselves instead of being spoon fed. The assumption behind these methods is that students are given an opportunity to actively construct meaning and understanding during the learning process. These methods discourage passive assimilation of knowledge and support acquisition of knowledge, skills and attitudes by solving problems in life.

There are many methods in participatory teaching methods or learner-centered methods. Among them, group discussion, project method and discovery learning are used as a treatment for experimental group in this paper.

Group Discussion

Group discussion is a primary teaching method which allows students to stimulate critical thinking. When using group discussion, the teacher can challenge them to think more deeply and to articulate their ideas more clearly. Learning within groups is more effective in terms of academic success comparison to competitive and individualized learning systems.

Steps in Group Discussion

- (1) Assign small groups
- (2) Assign a leader
- (3) Write problem
- (4) Attack problem
- (5) Record all solutions and draw conclusions (Dhand, 2010)

Project Method

Project method provides a practical approach to learning. This method leads to understanding and develops the ability to apply knowledge. The teacher has to work as a careful guide during the execution of the project. Students can perform constructivist activities in natural condition. Students are provided with various opportunities that can satisfy their interest and desires towards mathematics. Project method helps in promoting social interaction among students because they have to work in a group and have to interact with others to get information. As students gain knowledge directly through their own effort, they acquire permanent kind of information.

Steps in Project Method

- (1) Provide a situation
- (2) Choose and purpose
- (3) Plan the project
- (4) Execute the project
- (5) Judge the project
- (6) Record (Mishra, 2009)

Discovery Learning

Discovery learning is an active style of learning, originated by Jerome Bruner in the 1960s. Bruner emphasized “learning by doing.” With this, students actively participate instead of passively receiving knowledge and interact with their environment by exploring objects and thinking about questions. They are encouraged to think, ask questions, hypothesize, speculate, cooperate and collaborate with others. Discovery learning takes into consideration that all students have some background knowledge that they may be able to apply to mathematics at hand.

Steps in Discovery Learning

- (1) Select generalization
- (2) Set up a problem situation

- (3) Set up experiences that will bring out the essential elements
- (4) Set up experiences that will bring out contrasting elements
- (5) Draw generalization
- (6) Apply generalization (Callahan & Clark, 1988)

Research Method

Research Design and Procedure

The design adopted in this study was one of the true experimental designs, via, the posttest only control group design. At the start of the research experiment, students were randomly divided into two groups as experimental group and control group according to the scores of October test. In each school, the experimental group was given a treatment by using participatory teaching methods such as group discussion, project method and discovery learning. In each school, the control group was given a treatment by using formal instruction. At the end of the treatment period, all selected students had to sit for posttest and a questionnaire for students' attitude towards participatory teaching methods.

Instruments

A posttest was constructed to measure the mathematics achievement of the students. It consisted of two sections. Section (A) contained (10) multiple choice items and section (B) contained (8) five-mark items. Test items were constructed based on the content areas of Chapters (7) and (8) from mathematics textbook volume I and Chapters (7) and (8) from mathematics textbook volume II. This test was also constructed based on Bloom's taxonomy of educational objectives (knowledge, comprehension, application). The students had to answer all questions.

Table1 Table of Specifications for Posttest

Section	Question Level	Mathematics Textbook Volume I		Mathematics Textbook Volume II		Total
		Chapter		Chapter		
		(7)	(8)	(7)	(8)	
(A) 1 mark	Knowledge	-	1	3	1	10 1 mark × 10 (10 marks)
	Comprehension	1	-	-	3	
	Application	1	-	-	-	
(B) 5 marks	Knowledge	-	-	-	-	8 5 marks × 8 (40 marks)
	Comprehension	-	2	-	2	
	Application	2	-	2	-	

Questionnaire for students' attitude towards participatory teaching methods was developed based on the literature by Muhangwa, G. M. (2011), advantages of participatory teaching methods. This questionnaire consisted of (15) items on a five-point Likert scale of (1) to (5). It contained five dimensions. Each dimension contained three items.

Research Findings

Quantitative and qualitative studies are made in this research.

Quantitative Research Findings

Table 2 *t*-Values for Posttest Mathematics Achievement Scores

School	Group	N	M	SD	MD	<i>t</i>	<i>df</i>	Sig. (2-tailed)
BEHS (4), Pazundaung	Experimental	30	27.27	5.05	11.04	9.036	58	.000***
	Control	30	16.23	4.38				
BEHS (1), Latha	Experimental	30	32.17	4.89	18.70	17.428	58	.000***
	Control	30	13.47	3.27				

Note: *** $p < .001$

The result showed that there was a significant difference between the students who were taught by using participatory teaching methods and those who were taught with formal instruction on the overall scores of mathematics achievement in the selected.

Table 3 *t*-Values for Scores on Knowledge Level Questions

School	Group	N	M	SD	MD	<i>t</i>	<i>df</i>	Sig. (2-tailed)
BEHS (4), Pazundaung	Experimental	30	3.47	0.90	0.87	3.591	58	.001**
	Control	30	2.60	0.97				
BEHS (1), Latha	Experimental	30	3.30	1.06	1.10	4.151	58	.000***
	Control	30	2.20	0.99				

Note: ** $p < .01$, *** $p < 0.001$

Table 3 shows that there was a significant difference between the students who were taught by using participatory teaching methods and those who were taught with formal instruction in performing on knowledge level questions in the selected schools.

The comparison of means for knowledge level questions revealed that experimental groups who received participatory teaching methods did better in their knowledge level questions of mathematics achievement than control groups who did not receive them. Thus, teaching with participatory teaching methods could bring about the improvement of the students' ability to remember previously learned materials and recall ideas and specific facts schools (see Figure 1 & 2).

Table 4 *t*-Values for Scores on Comprehension Level Questions

School	Group	N	M	SD	MD	<i>t</i>	<i>df</i>	Sig. (2-tailed)
BEHS (4), Pazundaung	Experimental	30	19.03	3.68	8.10	8.628	58	.000***
	Control	30	10.93	3.59				
BEHS (1), Latha	Experimental	30	21.53	2.80	12.06	18.236	58	.000***
	Control	30	9.47	2.30				

Note: *** $p < .001$

The result showed that there was a significant difference between the students who were taught by using participatory teaching methods and those who were taught with formal instruction in performing on comprehension level questions in the selected schools.

It revealed that experimental groups who received participatory teaching methods did better in their comprehension level questions of mathematics achievement than control groups who did not receive them. Thus, teaching with participatory teaching methods could bring about the improvement of the students' ability to understand the meanings of learned materials, concepts and facts schools (see Figure 1 & 2).

Table 5 *t*-Values for Scores on Application Level Questions

School	Group	N	M	SD	MD	<i>t</i>	<i>df</i>	Sig. (2-tailed)
BEHS (4), Pazundaung	Experimental	30	4.77	2.19	2.10	4.358	58	.000***
	Control	30	2.67	1.47				
BEHS (1), Latha	Experimental	30	7.33	2.59	5.53	10.211	58	.000***
	Control	30	1.80	1.44				

Note: ****p* < .001

The result showed that there was a significant difference between the students who were taught by using participatory teaching methods and those who were taught with formal instruction in performing on application level questions in the selected schools.

The comparison of means for application level questions revealed that experimental groups who received participatory teaching methods did better in their application level questions of mathematics achievement than control groups who did not receive them. Thus, teaching with participatory teaching methods could bring about the improvement of the students' ability to apply knowledge and facts that they have learned in the new situations, use general ideas and generalize methods schools (see Figure 1 & 2).

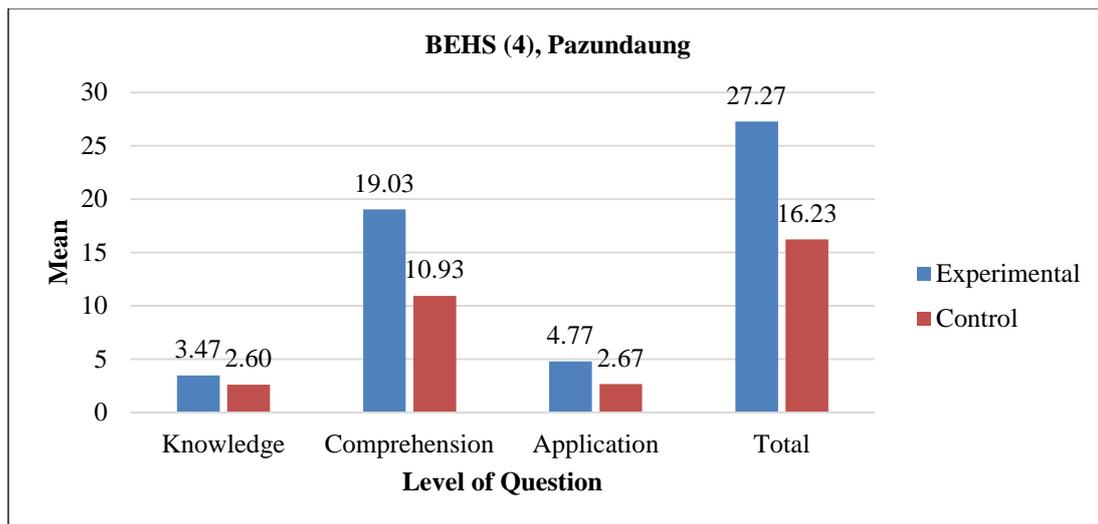


Figure 1 Comparison of Posttest Means of BEHS (4), Pazundaung

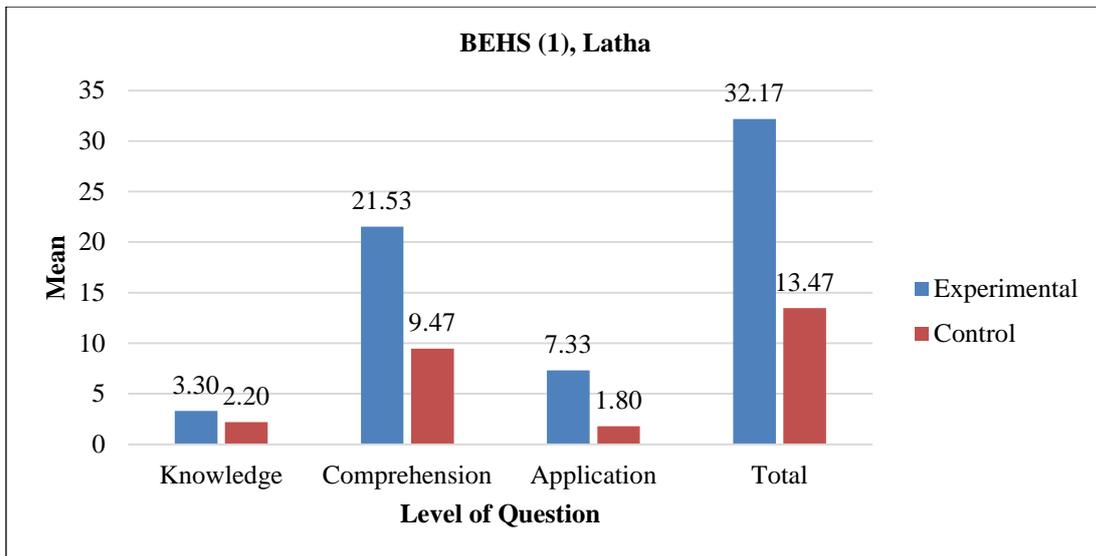


Figure 2 Comparison of Posttest Means of BEHS (1), Latha

Qualitative Research Findings

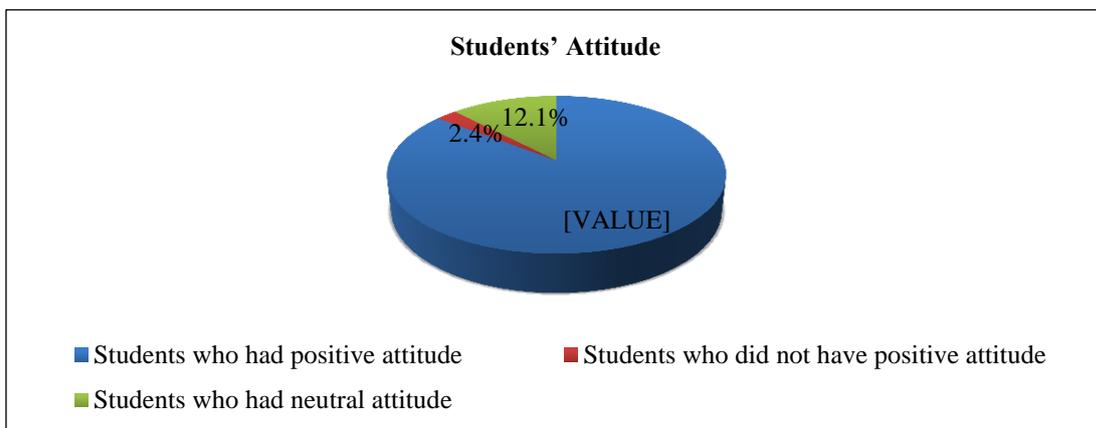


Figure 3 Percentage of Students' Attitude towards Participatory Teaching Methods

In this research, 85.5% of students of experimental groups have positive attitude towards participatory teaching methods. It can be interpreted that participatory teaching methods increase the students' interest, self-confidence, thinking, communication skill and problem solving skill. Thus, it can be summarized that the students' attitude towards participatory teaching methods is positive in both selected schools.

Conclusion

Discussion

According to the findings, the means of experimental groups were significantly higher than that of control groups in the selected sample schools. It showed that the use of participatory teaching methods had significant effect on mathematics achievement of the students. Thus, this finding supports the first hypothesis: There is a significant difference in mathematics achievement between Grade Six students who receive participatory teaching methods and who do not receive. It can be inferred that participatory teaching methods can achieve success in mathematics teaching and learning at the middle school level.

According to the comparison of means on each level questions for both selected schools, the findings showed the achievement of experimental groups was significantly higher than that of control groups. This finding supports the second, third, fourth hypotheses. There is a significant difference in mathematics achievement between experimental group and control group in performing knowledge, comprehension and application level questions. It can be interpreted that the students of experimental groups are more able to recognize the learned materials or information, to improve the ability to grasp the meaning of learned materials and to be more skillful in the use of ideas in particular situations than those of control groups.

One of the specific purposes of this research is to study students' attitude towards participatory teaching methods. According to the findings, 85.5% of students who had positive attitude on overall items of attitude questionnaire, 12.1% of those who had neutral attitude and 2.4% of those who did not have positive attitude on them. Thus, it can be summarized that students' attitude towards participatory teaching methods is positive in both selected schools. The finding supports the fifth hypothesis: The students who are taught with participatory teaching methods will have positive attitude towards participatory teaching methods. It can also be interpreted that participatory teaching methods increase the students' interest, self-confidence, thinking, communication skill and problem solving skill.

In this study, most of the students of experimental groups were alive, interested in their learning process and solved problems by themselves. Thus, this finding is consistent with Muhangwa (2011) who stated that participatory teaching methods make the students become more actively engaged in the learning process, solve problems, think critically, pose challenges and collaboratively construct knowledge. The situations in the class are contrary for teachers who were using traditional teaching.

Next, the students with group discussion were more active than those who received formal instruction. Group discussion increased the students' understanding of a lesson, supported in generating more ideas about a topic and helped the students to build confidence. Group discussion could lead to cognitive benefits by engaging the students in thinking of their ideas. By exchanging ideas and considering others' perspectives, the students were prompted to remember their existing ideas more as well as to integrate new ideas into their existing knowledge.

Then, although project method took time, it helped in growing knowledge and increased social participation. It encouraged the students' investigation and creativity. The students were motivated for further study. In this study, the students could make self-study activities, developed cooperation and showed their competence.

In discovery learning, the students participated more actively in learning process than the students who received formal instruction and fostered an attitude of inquiry. The result of this study revealed that discovery learning had an influence on the mastery of the students' mathematical concepts. The students involved actively in the learning process such as thinking by themselves, finding out contrasting elements and generalization of concepts.

In this study, the students of control groups were taught learning materials with formal instruction. The teacher directly explained the problems and the students listened passively at the same time. As the teacher rarely used group work in this classroom, the students were not able to discuss with their peers, work together and discover the solution by themselves. On the other hand, the students of experimental groups were actively involved in their learning process by

discussing among groups, working out projects and discovering the solutions in hand-on activities.

To sum up, the findings mentioned above pointed out that participatory teaching methods have positive contribution to the achievement of students in mathematics. The students were interested in teaching with them and they participated willingly in the teaching/learning process in this study. Through participatory teaching methods, the students can receive opportunities to learn mathematics through various activities under the facilitation of the teacher. Participatory teaching methods can be applied for teaching mathematics at all levels of basic education to help the students for attaining academic achievement. Thus, participatory teaching methods if employed in mathematics classroom would bring about higher achievement of the students.

Suggestions

Although group discussion has a few disadvantages such as difficulties in group position, teacher can overcome this problem with careful preparation. In the ways of accepting students' ideas, reinforcing their discussions and providing feedback at the necessary time, teacher can use group discussion without getting any constraints. Therefore, mathematics teaching and learning will be effective by utilizing group discussion.

One of the disadvantages of using project method is time-consuming. However, it depends on teacher's work and management. If teacher observes simultaneously and gives guidance at the specific time, using project method can make students active and successful in academic achievement. It cannot be denied that students participate actively in learning process, develop social communication and improve the skill of cooperation by using group project.

Every method has both advantages and disadvantages. So, discovery learning has a small number of disadvantages. But, it can make students develop feeling of autonomy, critical thinking skills and habit of searching information. Moreover, discovery learning can be used not only for groups but also for individuals. To sum up, participatory teaching methods such as group discussion, project method and discovery learning should be used for promoting communication skill among the students, participation in teaching/learning process, thinking skills and cooperation between teacher and students or among students.

Based on the research findings and interpretations, participatory teaching methods should be used in classroom teaching but this study is not perfect because there are some limitations in this study such as time duration and content areas. With respect to the research findings, the following points are suggested.

- The teacher should explain clearly to the students about the steps in the method used and allow them to participate in the teaching/learning process and the teacher should give the students guidance and help what they need.
- The teacher should manage carefully classroom conditions to reduce time constraints.
- The teacher should encourage and pay attention for their students to learn and participate enthusiastically in learning activities.
- The teacher should provide opportunities for the students to be able to apply their knowledge in real life.

- The teacher needs to relate the learned materials with real situation so that the students will be more interested in their learning.
- The teacher should allow the students to think critically, make hand-on activities and solve problems by themselves instead of memorizing facts and repetition of solving problems without reasoning skills.
- The teacher should make valuable opportunities to provide the students with a clear understanding of concepts by using teaching aids.
- The teacher should impart information by using questions or hints so that the students can get high retention in applying these methods.
- This study is specifically contributed to mathematics teaching at the middle school level. Although this research was concerned with mathematics teaching, it can also be applied in other subjects and various school levels including primary school level and high school level.
- There are many methods in participatory teaching methods. However, group discussion, project method and discovery learning were used. Thus, other methods involved in participatory teaching methods can be applied in further studies.
- This study was done in the Yangon Region. Therefore, further researches should be carried out in other States and Regions.

Conclusion

There are many sectors for the development of a country such as economics, politics and education. Thus, educated people are important resources to develop a country. At the basic education level, education is mostly dependent on the students' achievement in their academic subjects. Among many academic subjects, mathematics is one which dominates people's lives. Thus, in teaching mathematics, the teachers should not only teach facts, information and how to calculate problems, but also allow the students to think critically, participate in the learning process and study themselves to be more clear. That is why, the implications of participatory teaching methods may lead the students to be good in learning process and using mathematics in their daily life.

The main purpose of the present study is to study the effect of participatory teaching methods on students' achievement in mathematics at the middle school level. The students of experimental groups who received participatory teaching methods had higher achievement in mathematics than those of the control groups who received formal instruction. Statistical results verified that participatory teaching methods were superior in improving the students' mathematics achievement.

This may be because the exposure to participatory teaching methods allows the students to think critically and actively participate in the learning process. Another result was that the students of experimental groups could perform better in answering posttest at knowledge, comprehension and application levels than those of control groups. Therefore, it can be concluded that participatory teaching methods improve the students' ability to recall learned materials, remember information, comprehend learning materials and apply knowledge in new situation or problems.

Secondly, a qualitative study was done to study the students' attitude towards participatory teaching methods. According to this research, it can be interpreted that the attitude of the students towards participatory teaching methods was positive. Therefore, participatory teaching methods are useful methods in the classroom environment.

This study is conducted to study the effect of participatory teaching methods on students' achievement in mathematics at the middle school level. No study is perfect in one's effort. This study had to be carried out in four weeks duration for each group because of their December test, the time was short for conducting research in schools.

National Research Council (2009) illustrated that students who acquired hands-on, authentic activities may develop curiosity, interest and desire to learn more. Social skills can also develop as the students share perceptions and knowledge with other in discussion among groups. Mathematics teachers should make the students to participate in numerous activities and help them to understand more. The students should participate in learning that brings in real life situations.

Even though there are advantages and disadvantages in using participatory teaching methods, many researchers advocated the use of participatory teaching methods in classroom. It is known that one of the goals of education is to nurture students to participate actively in learning process and become lifelong learners. Participatory teaching methods encourage interaction between teachers, students, the content and environment in which learning occurs (Wolhuter, 2014). Participatory teaching methods are important teaching methods to achieve the aims of education and also contribute to teaching and learning mathematics.

To review, the study of the effect of participatory teaching methods is consistent with purposes and cover hypotheses of the research. Moreover, this study showed that the students' learning with active participation was more effective than learning with formal instruction. It improves not only the students' learning rate but also promotes their thinking ability. Besides, this result recommends many mathematics teachers to achieve their teaching/learning situation. The effective use of the participatory teaching methods has significant effect on the overall mathematics achievement of the students. Therefore, participatory teaching methods surely have positive contribution to the improvement of mathematics teaching at the middle school level and lead students to be keen on participating and learning and have a positive effect on students' academic achievement.

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