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The Effects of using Cooperative Learning on Student's Achievement and Attitude toward Mathematics

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ABSTRACT

The purposes of this research were to study the effects of using cooperative learning strategy on student's achievement and attitude toward mathematics. The topic used in this study is "The Complex Number". The sample consisted of 49 Thai students in Grade 11 at Satrinonthaburi School in the second semester, academic Year 2014. The cooperative learning strategy used was "Think Pair Share". The pre-test and post-test design, observation and questionnaire were employed in this study. A pre-test was given at the beginning of the lesson. During discussion in the classroom, the researcher observed students participated during mathematics class using planned Think-Pair-Share worksheet. A post-test was administered to measure the achievement of students. The results of this study indicated that using this cooperative learning strategy had a positive effect on students' achievement and attitude in learning mathematics.

Keyword: achievement in mathematics, attitudes, cooperative learning, think-pair-share

1. Introduction

Mathematics is proved useful in everyday life, not only that it helps improving the quality of life but it also allows people to live in harmony with each other (Cobb, P. 1991). Some students had realized this usefulness and had brought the ideas to everyday life, work, and studies. However, mathematical concepts were considered difficult by other students since they could not see the relationship between mathematics and their life. This was also on the principle that all students are different with unequal abilities to learn and achieve knowledge (Harper, G. F., and Maheady, L. 2007).

Communication is an essential tool for learning mathematics because students can clarify, expand, and share their ideas and understanding with friends. Students can communicate ideas with their peers about ways to solve particular problems. A student who clearly understands a particular concept can share his or her ideas and strategies with other students. Brainstorming can also be used to make a difficult decision in order to find optimal solutions. This work also would follow principle of equity. There would be high expectations for students to be able to work cooperatively and support one another as they work together.

Cooperative Learning is the strategic using of small groups so that students work together to enhance their own and each other's learning (Johnson, D., Johnson, R., & Smith, K. 1991). Cooperative learning enhance positive environment and develop cooperation and understanding of others while learning together. The strategy may be used to supplement other forms of instruction by giving students the opportunity to share idea one another, discuss in groups, or put into practice skills or information presented by instructor (Slavin, R.E. 1995). Moreover, students in classes of using cooperative learning strategy can enhance a more positive attitude toward themselves and mathematics (Johnson, D. & Johnson, R. 1994).

Think-Pair-Share method is one cooperative learning strategy that requires students to interact with their partners by share individual ideas in solution after a period of individual think time. The Think-Pair-Share strategy is designed to differentiate instruction by providing students time and structure for thinking on a given worksheets, enabling them to formulate individual ideas and share these ideas with a partner (Kagan, S., 1998). This learning method stimulates classroom interaction by encouraging of students' response, rather than using a traditional method in which a teacher poses a question and one student offers a response. Additionally, this method provides an opportunity for all students to share their thinking with at least one

other. In this method, a problem is posed, students have time to think about it individually, and then they work in pairs to solve the problem and share their ideas with the class (Baumeister, M. 1992).

The researcher was interested in applying a Think-Pair-Share method to improve students' achievement in mathematics since the practical work revealed that this subject was considered difficult and boring to many students. The selected topic was the "Complex Number" where students had to learn constructing of complex numbers, properties of the algebra, square root of complex numbers, graph and absolute value of complex numbers, polar form, the nth -roots of complex numbers, and polynomial equations in which students feel anxiety toward mathematics. This anxiety affects their performance in mathematics. Students who lack of mastery in mathematics were likely to be less successful, despite being in secondary schools for a long period (Lyle, S., 1993). This study would have determined if a Think-Pair-Share method could help increasing students' achievement in mathematics and if they had positive attitude toward mathematics.

2. Research objectives

The objectives of this study are as follows: 1) to study to effects of cooperative learning strategy on students' achievement toward mathematics and 2) to study to effects of cooperative learning strategy on students' attitude toward mathematics

3. Research Methodology

3.1 Participants

Participants in this study were 49 students in Grade 11, mathematics class, second semester of academic year 2014 at Satrinonthaburi School, Nonthaburi, Thailand.

3.2 Research Instruments

Achievement tests

This study used a pre-test to measure students' fundamental knowledge of mathematics and compared with post-test scores which were assigned after the treatment. Each test comprised 20 items on the "Complex Number" topic. The items in both tests were presented in a multiple-choice format. Each item had four alternative choices with one correct answer. Contents in both tests were based on concepts and principles of the complex number. The content validity and reliability of both tests was verified and strengthened by three professional mathematics teachers.

Questionnaire

A questionnaire was used to measure students' attitudes towards mathematics with application of the Think-Pair-Share method. A questionnaire contains 12 statements in which levels of agreement are rated from using Likert scale 1-5 points from Strongly Disagree to Strongly Agree. A questionnaire was reviewed and enhanced by three experts experienced in educational research.

3.3 Conceptual Framework

The conceptual framework of the study was shown in Figure 1. This shows how a Think-Pair-Share method was used as a part of the learning process.

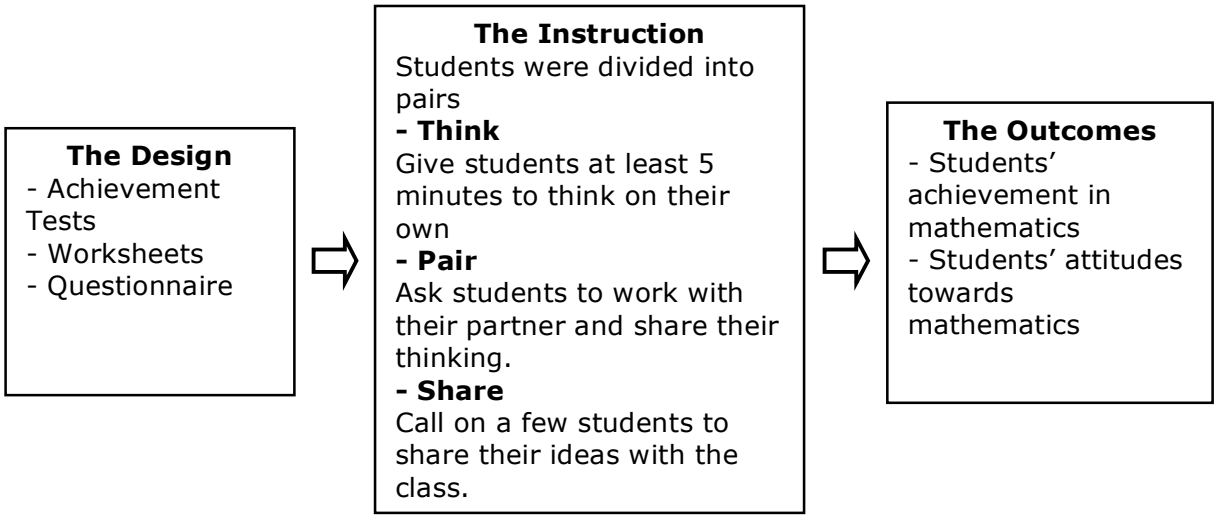

Figure 1
A conceptual framework

3.4 Data Collection and Analysis

This research was conducted following the lesson plan displayed in Table 1. There were 7 lesson plans in the "Complex Number".

Table 1
Lesson plans

No.	Topic
1	Constructing complex numbers
2	Properties of algebra
3	Square root of complex numbers
4	Graph and absolute value of complex numbers
5	Polar form
6	The nth-roots of complex numbers
7	Polynomial equations

This research was conducted and data was collected following these steps:
1) A pre-test was given at the beginning of the lesson.
2) The researcher taught in the specified topic as mentioned above by using think-pair-share method in the classroom.
3) The researcher observed students participation in the classroom.
4) A post-test was administered to measure the achievement of students and a questionnaire was used to measure students' attitudes towards mathematics
5) The researcher collected data from pre-test, post-test, and a questionnaire to determine students' achievement and attitudes toward mathematics after they had been instructed using a Think-Pair-Share method.

Data analysis comprised the scores on achievement tests and responses to the questionnaire. A t-test was performed to compare the means of the pre-test scores and post-test scores on achievement and attitude measures of the groups before and after the treatment.

4. Research Results

4.1 Achievement Results

The pre-test and post-test scores were analyze and displayed in Table 2. The total score of each test is 20 and the total number of students is 49.

Table 2
Student achievement test scores

	n	Mean		SD		t	df	Sig
		Pre-test	Post-test	Pre-test	Post-test			
Student achievement	49	5.47	14.63	1.79	1.27	34.84	48	0.00

According to the result, students' achievement through the mathematic activity based on a Think-Pair-Share method was analyzed by comparing pre-test and post-test scores with t-test applied, A t-test for dependent samples revealed a significant difference in testing scores between a pre-test and a post-test as $t(48)=34.84$, $p<0.05$.

4.2 Attitude Results

A questionnaire with attitude test scores is shown in Table 3 displaying a percentage score on each statement.

Table 3
A questionnaire with results

No	Statements	Strongly Agree (%)	Agree (%)	Undecided (%)	Disagree (%)	Strongly Disagree (%)
1	I like to work in groups.	40.82	53.06	4.08	2.04	0.00
2	Working in a group helps me understand	55.10	36.73	6.12	2.04	0.00
No	Statements	Strongly Agree (%)	Agree (%)	Undecided (%)	Disagree (%)	Strongly Disagree (%)
3	Working in a group helps me get the work completed on time.	38.78	42.86	16.33	2.04	0.00
4	I ask questions of others when I work in a group.	46.94	46.94	6.12	0.00	0.00
5	Others in the group ask me questions when we work in groups.	42.86	42.86	12.24	2.04	0.00
6	I have more confidence to try problems when I work in a group.	44.90	34.69	18.37	2.04	0.00
7	Working in a group helps me understand the concepts better.	53.06	42.86	4.08	0.00	0.00
8	I have the opportunity to share ideas in group.	75.51	18.37	4.08	2.04	0.00
9	When I work in a small group, everyone is encouraged to contribute.	77.55	20.41	2.04	0.00	0.00
10	When I work in a small group, ideas and opinions are treated with respect.	44.90	44.90	10.20	0.00	0.00
11	I am comfortable asking the teacher questions.	67.35	28.57	4.08	0.00	0.00

12	I am comfortable asking a group member questions.	71.43	24.49	2.04	2.04	0.00

The results on student attitudes towards mathematics after applying a Think-Pair-Share method showed that the most students strongly agree with statement "When I work in a small group, everyone is encouraged to contribute." The students in the study perceived that think-pair-share method was beneficial to them.

5. Conclusion

This research had studied the effects of using a Think-Pair-Share method on students' achievement in mathematics and student attitudes towards learning mathematics. The results convinced that using this Think-Pair-Share method in the classroom can improve students' achievement and has positive effects on students' attitude toward mathematics. The questionnaire showed results in attitudes. Someone student comment that, "I have more confidence to try problems when I work in group". However, implementation of a Think-Pair-Share method should be developing the thinking of cooperative learning in terms of knowledge, skills, and problem solving of each student. Teachers can learn from each other and can share these ideas from research's result in this study with other teachers who are interested in developing group learning to produce better work.

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