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Abstract

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The Effects of Cooperative Learning on Students' Mathematics Achievement and Attitude towards Mathematics

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Abstract: Problem statement: The purpose of this study was to determine the effect of cooperative learning on mathematics achievement and attitude towards mathematics. **Approach:** This quasi-experimental study was carried out on two form one classes in Miri, Sarawak. One class (n = 44) was assigned as an experimental group and the other (n = 38) was assigned as a control group. The two groups were pre-tested prior the implementation. At the end of the study, post test was given, while daily quiz was used as a tool for formative testing. Teaching and learning process was carried out for two weeks. Data were analyzed using the t-test to determine performance by comparing the mean of the post test for treatment and control group. **Results:** The results of this study showed that cooperative learning methods improve students' achievement in mathematics and attitude towards mathematics. **Conclusion:** The researchers concluded that cooperative learning is an effective approach, which mathematics teachers need to incorporate in their teaching.

Key words: Cooperative learning, motivation, achievement

INTRODUCTION

At present mathematics is widely use in various fields and covering a wide range of activities. However, the decline in mathematics achievement is of concern. Among the reasons of the decline in mathematics achievement in schools is because students consider mathematics as a difficult and boring subject According to Keefe (1997), the phenomenon of frustration among teachers and students need to be overcome in order to achieve excellence in mathematics. Therefore, teachers should take note of the needs of individual students. According to him, the individual needs of students should be treated accordingly so that the teaching and learning is effective. Mathematics achievement is often discussed by educators in our country. The highlight of their discussion focused on the differences and variations in student achievement based on their PMR (Lower Secondary Assessment), SPM (Malaysia Certificate of Education) and STPM (Malaysian Higher School Certificate) examinations each year. According to Malaysian Examination Board, student achievements are not stable and vary from year to year. Students who are weak in Mathematics may feel less confident and did not want to choose science as an option to further their education.

Clearly, student achievement in mathematics has not been good enough. According to Sabri (2006), mathematics achievement level of PMR (Lower Secondary Assessment) showed small fluctuation in percentage from year to year. However, the increase in the percentage who pass will increase students in the Science stream at the SPM (Malaysia Certificate of Education) level. In the Malaysian education system, achieving the rank of D means the student can only achieve a minimum mastery level while achieving the rank of E means the student does not achieve the minimum mastery level. This decision became one of the indicators that reflect the level of the students who are weak in mathematics. Therefore, efforts should be undertaken to immediately to improve the situation. The teaching of mathematics is not about dispensing rules, definitions and procedures for students to memorize, but engaging students as active participants through discussion and collaboration among students (Posamentier *et al*., 2006). Learning will be more successful if they are given the opportunity to explain or clarify ideas (Burns, 1990). Lau *et al*. (2009) explains that "the mathematics skills required for youth of today's and adults of tomorrow to function in the workplace are different from that for youth and adults of yesterday". In terms of pedagogy, the development

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of education now requires teaching strategies that emphasize student involvement.

According to Johnson and Johnson (1990) to achieve success in learning mathematics, students should be given the opportunity to communicate mathematically, reasoning mathematically, develop self-confidence to solve mathematics problems. One of the ways this can be done is through cooperative learning. In cooperative learning, students study in small groups to achieve the same goals using social skills. Many studies show that cooperative learning can improve performance, long-term memory and positive attitudes towards mathematics, self concept and social skills. More opportunities should be given to discussion, problem solving, creating solutions and working with peers. Several educators in the field of mathematics education conducted studies using cooperative learning and found increase in students' mathematics achievement (Brush, 1997; Isik and Tarim, 2009; Nichols and Miller, 1994; Tarim, 2009; Tarim and Akdeniz, 2008).

Shimazoe and Aldrich (2010) provides several benefits on the use of cooperative learning approach for students. First, cooperative learning promotes deep learning of materials. Second, students achieve better grades in cooperative learning compared to competitive or individual learning. Third, students learn social skills and civic values. Fourth, students learn higher-order, critical thinking skills. Fifth, cooperative learning promotes personal growth. Finally, students develop positive attitudes toward autonomous learning.

Apart from mathematics achievement, attitude is also a major focus in cooperative learning study. A study conducted by Ifamuyiwa and Akinsola (2008) found that students in the experimental group showed a positive attitude towards mathematics. Similarly, Brush (1997), also found that students in the experimental group showed positive attitudes towards mathematics. However, a study by Tarim and Akdeniz (2008) found no significant difference was observed regarding students' attitude towards mathematics. Based on the literature it can be said that cooperative learning is effective in enhancing the achievement and produce inconsistent results regarding attitude of students. Therefore, the researchers want to conduct this research in the hope that teachers can used the cooperative learning methods especially Student Teams-Achievement Divisions (STAD) in their teaching. Thus, researchers want to study the effects of the use of STAD on mathematics achievement and student attitudes towards mathematics. Specifically, the objectives of the study were to determine:

- Whether there are differences in achievement in mathematics between the experimental group and the control group
- Whether there are differences in students' attitude towards mathematics between the experimental group and the control group

MATERIALS AND METHODS

Since the classes existed as intact groups, the study used a quasi-experimental non-equivalent control group design. To control for teachers' training and experience as sources of internal invalidity, only teachers of equivalent training and experience were chosen. Convenience sampling technique was used to select the schools that formed the study sample. The participants were 82 Form One students from one of the school in Miri, Sarawak. Of these respondents, 44 were in the experimental class, while 38 others were in the control class. Students in Form One in Malaysian secondary schools are of an average of 13 years old. The study was carried out for two weeks. Student Teams-Achievement Divisions (STAD) developed by Slavin (1995) was used as the cooperative model.

Instrumentation:

Achievement test: In this study, the achievement test was used to measure the students' mastery of the topic of fractions. The pre and post test contained 16 objectives questions and 10 subjective questions. The time allocated is 60 min. Each subjective item is allocated five points, while two marks allocated to each objectives item. All items used are based on form 1 mathematics syllabus. Validity is an important feature for an instrument (Wiersma, 2000). An instrument is said to have high validity if the degree of its ability to measure what it should be measured is high. All the items were reviewed by the Head of Department of Mathematics and Science and expert teachers for validation.

Attitude towards mathematics: A set of attitude questionnaire items have been adopted and modified by the researchers. The instrument was given to experts in mathematics education for validation. Since the items were not scored dichotomously, the reliability coefficient of the test was estimated using Cronbach's coefficient alpha (α) as provided by Gregory (2004). The reliability coefficient was found to be 0.81. Attitude questionnaire contains 15 items. In this questionnaire, all respondents were required to choose the answer that reflects their own views and stance on the statements that are administered in accordance with the Likert scale of five points, strongly disagree-1 to strongly agree-5 points.

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RESULTS

Table 1 shows the demographics variables. The sample included 38 male (47.4%) and 44 (53.7%) female. In terms of ethnic group, the Iban 45 (54.9%) is the majority. The monthly parents' incomes in Ringgit Malaysian (RM) of the respondents were illustrated in detail. Most of the student, 54 (65.9%) had a parent income of between RM500-RM1000 per month.

Effects of cooperative learning on students' mathematics achievement: To determine the effects of cooperative learning on students' achievement, an analysis of students' pre and post test mean scores was carried out. Table 2 shows the pre-test scores of the experimental and the control group.

The results indicate that the mean score for experimental group was 50.34 with a standard deviation of 10.92 and that of control group was 47.68 with a standard deviation of 11.18. The results also indicate that the difference between the achievement mean scores for experimental and control groups t(80) = 0.281 is not significant at the alpha level of 0.05. This, therefore, means that the experimental and control groups were at the same level of achievement at the start of the study.

Table 3 shows the post-test achievement mean scores of the experimental and the control group. The results indicate that the mean score for experimental group was 56.18 and that of control group was 50.18. The results also indicate that the difference between the achievement mean scores for experimental and control groups t(80) = 0.031 is significant at the alpha level of 0.05.

As shown in Table 4, the results indicate that the mean score for experimental group was 41.41 with a standard deviation of 6.82 and that of control group was 40.50 with a standard deviation of 7.19. The results also indicate that the difference between the attitude mean scores for experimental and control groups t(80) = 0.559 is not significant at the alpha level of 0.05. This, therefore, means that the experimental and control groups were at the same level of attitude at the start of the study.

Table 5 shows the post-test attitude mean scores of the experimental and the control group. The results indicate that the mean score for experimental group was 48.02 and that of control group was 41.68. The results also indicate that the difference between the attitude mean scores for experimental and control groups t(80) = 0.000 is significant at the alpha level of 0.05.

Table 1: Respondents' profile

	Variables	Frequency	Percentage
Gender	Male	38	46.3
	Female	44	53.7
Ethnic groups	Iban	45	54.9
	Chinese	18	21.9
	Malay	11	13.4
	Others	8	9.8
Parent Income	<RM 500	11	13.4
	RM 500- RM 1,000	54	65.9
	RM 1,001- RM 2,000	11	13.4
	>RM 2,000	6	7.3

Table 2: Pre-test achievement mean scores of the experimental and the control group

Groups	N	Mean	SD	t-value	df	p-value
Experimental	44	50.34	10.92	-1.086	80	0.281
Control	38	47.68	11.18			

Table 3: Post-test achievement scores of the experimental and the control group

Groups	N	Mean	t-value	df	p-value
Experimental	44	56.18	-2.189	80	0.031
Control	38	50.18			

Table 4: Pre-test attitude mean scores of the experimental and the control group

Groups	N	Mean	SD	t-value	df	p-value
Experimental	44	41.41	6.82	-0.578	80	0.559
Control	38	40.50	7.19			

Table 5: Post-test attitude mean scores of the experimental and the control group

Groups	N	Mean	t-value	df	p-value
Experimental	44	48.02	-4.801	80	0.000
Control	38	41.68			

DISCUSSION

Mathematics achievements: The results of this study indicate that the cooperative learning approach resulted in higher achievement than the traditional teaching approaches. The reason for the increase in students' achievement could be caused by the students involvement in explaining and receiving explanation in which the concepts can be easily understood. Cooperative learning gives more space and opportunities for students to discuss, solve problems, create solutions, provide ideas and help each other. The results were also in line with previous studies, as reported by some researchers such as Tarim and Akdeniz (2008) and Nichols and Miller (1994). Traditional teaching methods are teacher based, therefore, less opportunity is given to students for discussion, problem solving, creating solutions and working with peers.

Attitude towards mathematics: The results of this study also indicate that the cooperative learning approach increase attitude towards mathematics. This is probably because when students work in group they feel that they can depend on others for help and

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therefore increase their confidence in solving mathematics problem. This may indirectly change their attitudes towards mathematics. Cooperative learning also emphasizes social interaction and relationships among groups of students in particular and among classmates in general. Cooperative learning actively involves students in the learning process. These findings are consistent with the findings of some previous researchers such as Ifamuyiwa and Akinsola (2008) and Brush (1997).

CONCLUSION

Student-centered approaches such as cooperative learning improve mathematics achievement and attitudes towards mathematics among students. Therefore, teachers in schools, especially teachers who teach mathematics need to be aware of the benefits and importance of cooperative learning and thus changing the practice of teacher-centered teaching methods to student-centered teaching methods. There are positive changes taking place when teachers change their teaching methods towards a more student-centered approach. Teachers need to master the mathematical content to be delivered and plan how to implement cooperative learning better. Cooperative learning should be employed especially STAD so that students can be help each other in small groups. Therefore, teachers are encouraged to practice these methods regularly and effectively. The results showed that cooperative learning could have a positive effect on the formation of a more positive attitude towards mathematics among students. However, attitude is something very abstract and subjective in detecting changes in the short term. This study only lasted for two weeks. This means that students are exposed to learning in a very short period. Therefore, research should take a longer time span so that the results of this study can be validated.

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REFERENCES

Brush, T., 1997. The effects on student achievement and attitudes when using integrated learning system with cooperative pairs. Educ. Tech. Res. Dev., 45: 51-64. DOI: 10.1007/ BF02299612

Burns, M., 1990. The Math Solution: Using Groups of Four. In: Cooperative Learning in Mathematics, Davidson, N. (Ed.). Addison-Wesley, ISBN: 0-201-23299-5, pp: 25.

Gregory, R.J., 2004. Psychological Testing: History, Principle and Application. 4th Edn., Allyn and Bacon, Boston, ISBN: 0-205-35472-6, pp: 86.

Ifamuyiwa, S.A. and M.K. Akinsola, 2008. Improving senior secondary school students attitude towards mathematics through self and cooperative-instructional strategies. Int. J. Math. Educ. Sci., Technol., 39: 569-585. DOI: 10.1080/00207390801986874

Isik, D. and K. Tarim, 2009. The effects of the cooperative learning method supported by multiple intelligence theory on Turkish elementary students mathematics achievement. Asia Pacific Educ. Rev., 10: 465-474. DOI: 10.1007/s12564-009-9049-5

Johnson, D.W. and R.T. Johnson, 1990. Using Cooperative Learning in Math. In: Cooperative Learning in Mathematics, Davidson. N. (Ed.). Addison-Wesley, ISBN: 0-201-23299-5, pp: 122.

Keefe, J.W., 1997. Learning Style Theory and Practice. National Association of Secondary School Principals, Reston, ISBN: 0-882-201-X, pp: 25.

Lau, P.N.K., P. Singh and T.Y. Hwa, 2009. Constructing mathematics in an interactive classroom context. Educ. Stud. Math., 72: 307-324. DOI: 10.1007/s10649-009-9196-y

Nichols, J.D. and R.B. Miller, 1994. Cooperative learning and student motivation. Contem. Educ. Psychol., 19: 167-178. DOI: 1006/s10649-007-9088-y

Posamentier, A.S., B.S. Smith and J. Stepelman, 2006. Teaching Secondary Mathematics: Techniques and Enrichment Units. 7th Edn., Pearson Education, New Jersey, ISBN: 0-13-118520-9, pp: 6.

Sabri, A., 2006. Issues in Mathematics Education. Utusan Publications and Distributors, ISBN: 967-61-1783-8, pp: 10.

Shimazoe, J. and H. Aldrich, 2010. Group work can be gratifying: Understanding and overcoming resistance to cooperative learning. Coll. Teach., 58: 52-57. DOI: 10.1080/ 87567550903418594

Slavin, R.E., 1995. Cooperative Learning: Theory, Research and Practice. Allyn and Bacon, ISBN: 0-205-15630-4, pp: 71.

Tarim, K. and F. Akdeniz, 2008. The effects of cooperative learning on Turkish elementary students' mathematics achievement and attitude towards mathematics using TAI and STAD methods. Educ. Stud. Math., 67: 77-91.

Tarim, K., 2009. The effects of cooperative learning on preschoolers' mathematics problem solving ability. Educ. Stud. Math., 72: 325-340. DOI: 10.1007/s10649-069-9197-x

Wiersma, W., 2000. Research Methods in Education: An Introduction. 7th Edn., Allyn and Bacon, Massachussetts, ISBN: 0-205-15654-1, pp: 311.

Discussion Publishers edition DPR-2026-1391 https://discussionpublishers.com/research/0d44c0bf-efc6-4fdf-aa66-0bb551ffd450