

THE EFFECTIVENESS OF COLLABORATIVE LEARNING IN THE TEACHING OF FORM FOUR MATHEMATICAL REASONING

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Abstract. Collaborative learning refers to the form of classroom organization in which students work together, in small groups, on a shared activity and with a common goal. This study focused on looking at the effectiveness of collaborative learning in the teaching of form four mathematical reasoning, and the possible effects of gender on the instructional methods in a Malaysian government secondary school. This study also looked at the gender effects on interest toward learning mathematics and perceptions of the teaching methods. The study was carried out using a pretest-posttest quasi-experiment research design with one treatment group and one control group. The study used two intact classes at a government secondary school in Kuching, Sarawak, Malaysia. The treatment class was taught using collaborative learning while the control class was taught using lecture-based instruction. The research instruments used in the study to collect data consisted of a pretest, posttest and questionnaire. The result showed that the collaborative learning group outperformed the traditional instructional group. In addition, female students obtained better results compared to male students in both of the instructional method. Majority of the students also preferred collaborative learning and collaborative learning group also showed higher interest in learning mathematics. However, the result showed that there were no gender effects on the instructional methods, interest toward learning mathematics and perceptions of the teaching methods.

Keywords: Collaborative; collaborative learning; effectiveness; gender; mathematical reasoning

Abstrak. Pembelajaran kolaboratif merujuk kepada organisasi bilik darjah di mana pelajar bekerjasama dalam kumpulan yang kecil melakukan aktiviti yang dikongsi tetapi mempunyai matlamat yang sama. Kajian ini mengkaji keberkesanan pembelajaran kolaboratif dalam pengajaran topik "Penaakulan Matematik" tingkatan empat dan kesan jantina kepada keberkesanan kaedah pengajaran ini di sebuah sekolah menengah kerajaan Malaysia. Kajian ini juga melihat kesan jantina ke atas minat pelajar terhadap pembelajaran matematik dan persepsi kepada kaedah pengajaran. Kajian ini dijalankan menggunakan kajian berbentuk ujian pra-pasca kuasi-eksperiment dengan satu kumpulan kajian dan satu kumpulan kawalan. Kajian ini menggunakan dua kelas di sebuah sekolah menengah kerajaan di Kuching, Sarawak, Malaysia. Kelas kajian telah diajar menggunakan pembelajaran kolaboratif manakala kelas kawalan telah

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diajar menggunakan pembelajaran secara lisan. Alat ukur kajian adalah ujian pra, ujian pasca dan borang soal selidik. Keputusan kajian menunjukkan kumpulan pembelajaran kolaboratif menunjukkan keputusan yang lebih baik berbanding dengan kumpulan pembelajaran tradisional. Tambahan pula, pelajar perempuan mendapat keputusan yang lebih baik jika dibandingkan dengan pelajar lelaki dalam kedua-dua kaedah pengajaran. Majoriti pelajar juga lebih gemar pembelajaran kolaboratif dan kumpulan kolaboratif menunjukkan minat yang tinggi dalam pembelajaran matematik. Akan tetapi, keputusan menunjukkan bahawa tiada kesan jantina terhadap kaedah pengajaran, minat pelajar terhadap pembelajaran matematik dan persepsi kepada kaedah pengajaran.

Kata kunci: Kolaboratif; pembelajaran kolaboratif; keberkesanan; jantina; penaakulan Matematik

1.0 INTRODUCTION

The continuous development of a country is very important as it will determine the survival of the nation. China and India are examples of countries that are emerging and progressing rapidly towards becoming a developed nation to be able to compete with other nations in the global world (Saran & Guo, 2004). Malaysia also strives to become a fully developed nation by the year 2020 as envisaged by our former Prime Minister, Tun Dr. Mahathir Mohammad (The Government of Malaysia, 2007).

In order to attain this vision, changes to the educational system are inevitable and is one of most crucial component of developing a country. Our education system needs to produce knowledge workers with a sufficiently high literacy in mathematics. According to Taylor (1998), knowledge workers are workers who create, modify and synthesize knowledge. To become knowledge worker, the acquisitions of scientific and technological literacy as thinking tool are essential. Literacy in mathematics is a must in this context as it is the language of science and technology and the foundation for the technological age. In a developed nation, those who are equipped with high mathematics competency are able to carry out complex tasks effectively and efficiently, especially in management and administration (Mok, 1993). Fong (1993) regarded mathematics as an indispensable tool, a much needed subject in this age of modern of technology.

To have a sufficiently high literacy in mathematics, students need to have good mathematics performance and high mathematics achievement. Hence, school administrators and other stakeholders are beginning to recognize that the

educational system needs fundamental changes to keep up with the pace of changes in the knowledge and pedagogical fields. Some educational researchers and practitioners have called for a change from the traditional educational system to one that emphasizes interconnectedness, active learning, and shared decision making, arguing that the traditional classroom competition is not healthy (Kagan, 2003). How can teachers avoid the problems associated with classroom competition and motivate students to think analytically and creatively by themselves? One alternative method that teachers can use is through collaborative learning.

Collaborative learning refers to the form of classroom organization in which students work together, in small groups, on a shared activity and with a common goal and is noticeable in most problem solving subjects such as mathematics (Barnes, 1998). According to Edwards (2002), peer collaboration is effective for mathematical tasks which require reasoning but not for tasks which require rote learning. Some studies in cooperative mathematics learning in small groups call for the direct teaching of collaborative skills or team building to enable groups to work effectively (Edwards, 2002).

Collaborative learning method is not a new teaching method as teachers have used it for many years in various forms (Prendergast, 2004). Although some advanced countries have implemented collaborative learning, this instructional approach has yet to be implemented successfully in Malaysia. Based on the findings of Merdeka Centre for Opinion Research (2005), the present educational system in Malaysia is still largely examination oriented. Students who learned in an examination oriented learning environment are likely to forget what they have learned in school as it can best be metaphorized as “chew, spit and forget”. As learning is all about understanding, the use of examination oriented instructional approach trains students to memorize certain facts and does not allow them to think in a creative matter. The examination oriented classrooms are also less attractive to students as there are fewer activities for the students and involved mainly passive learning.

In order to improve on the teacher-centred classrooms, some innovations need to be developed and one of it is to implement learner-centred teaching and learning methods such as collaborative learning. With collaborative learning, students will have the opportunity to experience more meaningful and motivating lessons in the classroom (Pendergrass & Sun, 1997). They will also able to develop inquiry skills which is essential for the development of knowledge workers

of the future. The use of group based learning approach such as collaborative learning will enable students to learn the spirit of working together as a team which is an essential skill in the real life situation.

Although studies have been conducted in the Western context, it cannot be directly used in the Malaysia's education setting because students in Malaysia behave differently, are from different cultural background and may have different learning preferences compared with students from other countries. Other factors such as different school environment and social expectation could also impact on the findings of similar studies done in Malaysia. Hence, it is appropriate for a study to determine the applicability of collaborative learning approach to be used in the local setting for mathematics teaching. Determining the effectiveness of using collaborative learning in mathematics can lead to the adoption of this teaching approach of mathematics which could improve the mathematics achievement among students. This can help Malaysia towards achieving its goal of becoming a develop nation by the year 2020.

2.0 PURPOSES OF THE STUDY

The main objective of this study was to determine whether collaborative learning approach would produce higher test achievement scores among students than the traditional form of instruction for the teaching of mathematical reasoning in form four. To achieve the objective of this study, the following hypotheses were generated.

- (1) There were no difference in the mathematics achievement between the groups of students taught using collaborative learning and traditional instructional method for the topic of Mathematical Reasoning.
- (2) There were no differences in mathematics achievement based on students' gender.
- (3) There was no interaction effect between teaching methods (collaborative learning and traditional instructional method) and students' gender on mathematics achievement.
- (4) There were no differences in students' interest in the subject based on gender and teaching methods.

- (5) There were no differences in students' perceptions on the teaching method based on gender and teaching methods.
- (6) There were no differences in students' preferences for the traditional instructional method and collaborative learning.

3.0 LITERATURE REVIEW

3.1 Collaborative Learning

Collaborative learning refers to the forms of classroom organization in which students work together, in small groups, on a shared activity and with a common goal (Barnes, 1998). Srinivas (2007) defined collaborative learning as an instructional approach to teaching and learning that involves groups of learners working together to solve a problem, complete a task, or create a product. Besides that, collaborative learning can be also defined as a philosophy of working together, building together, learning together, changing together and improving together (Wiersema, 2000). According to Cohen (1994) and Salvin (1983), collaborative learning occurs when students learn by interacting with each other rather than only with the teacher. While cooperative learning is usually defined as small group learning meeting a set rather strict criteria, collaborative learning is a more general model where students work together to achieve a certain goal (Case, Stevens, & Cooper, 2007).

Collaborative learning activities are varied, but most centred on students' exploration or application of the course material, not simply the teacher's presentation or explication of it. Srinivas (2007) stressed that collaborative learning is based on the idea that learning is a naturally social act in which the participants talk among themselves. Collaborative learning is a personal philosophy, not just a classroom technique as in all situations where people come together in groups, it suggests a way of dealing with people which respects and highlights individual group members' abilities and contributions (Patniz, 1996).

Collaborative learning is not one single mechanism where if one talks about "learning from collaboration", one should also talk about "learning from being alone" (Dillenbourg, 1999). Individual cognitive systems learn to perform some activities (reading, building and predicting), which trigger some learning mechanisms (induction, deduction, compilation). Similarly, peers do not learn

because they are two, but because they perform some activities which trigger specific learning mechanisms (Smith & MacGregor, 1992). Although this includes activities or mechanisms which are performed individually, the interaction among subjects also generates extra activities which generate extra cognitive mechanisms (knowledge elicitation, internalization, reduced cognitive load). In collaborative learning situations, students are not simply taking in new information or ideas as they are creating something new with the information and ideas which acts of intellectual processing of constructing meaning or creating something new and these are crucial to learning (Smith & MacGregor, 1992).

3.2 Characteristics of Collaborative Learning

According to Berge (1997), the term collaborative learning covers a broad territory of approaches to education, and it includes a wide range of activities, goals, and processes. Smith and MacGregor (1992) characterize collaborative learning as the many educational approaches involving joint intellectual effort by students, or students and teachers together and most collaborative learning activities focus on the students' exploration and application of the course material, not the teacher's presentation of it. Rockwood (1995) distinguished collaborative learning as being connected to the social constructionist's view that knowledge is a social construct. According to Srinivas (2007), collaborative learning is characterized by:

- (1) Learning is an active process whereby learners assimilate the information and relate this new knowledge to a framework of prior knowledge,
- (2) Learning requires a challenge that opens the door for the learner to actively engage his/her peers, and to process and synthesize information rather than simply memorize and regurgitate it,
- (3) Learners benefit when exposed to diverse viewpoints from people with varied backgrounds,
- (4) Learning flourishes in a social environment where conversation between learners takes place. During this intellectual gymnastics, the learner creates a framework and meaning to the discourse, and,
- (5) In the collaborative learning environment, the learners are challenged both socially and emotionally as they listen to different perspectives, and are

required to articulate and defend their ideas. In so doing, the learners begin to create their own unique conceptual frameworks and not rely solely on an expert's or a text's framework.

Hence, in a collaborative learning setting, learners have the chance to interact with peers, present and defend ideas, exchange diverse beliefs, question other conceptual frameworks, and be actively engaged.

3.3 Empirical Findings on Collaborative Learning in Mathematics

Collaborative learning has been shown to have beneficial sides in the mathematics learning settings. Pietsch (2005) used collaborative learning in his research and found that when students were collaborating with other students, it provided them with the opportunities to reformulate their ideas by comparing their perspectives with the multiple perspectives of others. Collaborative groups also produce multiple overlapping zones of proximal development (Brown, 1994; Brown, Ellery, & Campione, 1998) through which individuals can make progress within the region of sensitivity beyond their current level. Furthermore, according to Pietsch (2005), students who were involved in collaborative learning demonstrated a shift in their thinking towards the development of a sense of responsibility for other members of the group. Students who were more advanced in their understanding showed signs of an awareness of the needs of others and greater social responsibility.

Edward and Jones (2003) also researched collaborative learning in the field of mathematics. In their study, a random sample of seven students were selected from the classes of a teacher who taught in a United Kingdom inner-city comprehensive secondary school whose mathematics results in national testing were approximately in line with the national average. The seven students were randomly selected from the following classes: two from the low attaining Year 11 class, three from the high attaining Year 10 class, and two from the middle attaining Year eight class. All the students were taught by the same mathematics teacher throughout their experience of collaborative group work in mathematics. Using an interview schedule based on Mulryan (1994), they found out that collaborative learning made the students felt confident and successful, and resulted

in faster rate of learning. Collaborative learning also made the students realized the important of working together with friends in a group.

In Ruxue's (2004) study, the concept of collaborative learning environment was used to help students in the University of Guangxi, China to improve understanding of mathematical concepts. According to Ruxue's (2004) findings, mathematics was more fun and students' interest in mathematics was increased when the students worked in collaborative groups.

4.0 METHODS

4.1 Research Design

The study was carried out using a pretest-posttest quasi-experimental design with one treatment group and one control group. The first independent variable was the instructional method, which consisted of collaborative learning (treatment) and traditional lectures (control). Another independent variable was the students' gender. The dependent variables were the students' mathematics achievement and preference of the teaching methods.

4.2 Samples

The participants for this study were Form four students from the two of the 13 classes in a government school, SMK Siburan, Kuching, Sarawak. Each of the class consisted of 34 students with different backgrounds (gender, race and academic achievement). The two classes involved in this study were randomly selected and were taught by the researcher.

4.3 Research Instruments

The research instruments used in this research were the pretest and posttest (achievement tests) and a questionnaire. Table 1 showed the examples of the pretest and posttest questions. Both the pretest and posttest covered Mathematics Reasoning, a topic in the form four mathematics syllabuses. The pretest and

posttest consisted of two parts. Part one had twenty multiple choice questions, whereas part two consisted of twenty subjective questions. The pretest and posttest were parallel forms and were validated by the senior teachers of the Mathematics Department in the school. A questionnaire with twenty six items was also used to obtain information regarding the students’ preferences toward the teaching methods used, interests in learning mathematics and demographics information. The questionnaire was validated by a mathematics educator at Universiti Malaysia Sarawak.

Table 1 Examples of the pretest and posttest questions

	Pretest	Posttest
Section A: Objective Questions	1. “If $p = 3$, then $2p - 3 = 3$.” State the antecedent of the implication above. A $p = 3$ B $2p - 3$ C $2p = 3 + 3$ D $2p - 3 = 3$	1. “If $q = 4$, then $2q - 4 = 4$.” State the antecedent of the implication above. A $2q = 4$ B $q = 4$ C $2q = 4 + 4$ D $2q - 4 = 4$
Section B: Subjective Questions	2. Write a mathematical statement in the form of “If p , then q ” based on the following information. Antecedent: Frogs lives in water and on land. Consequent: Frogs are amphibian. Answer:	2. Write a mathematical statement in the form of “If p , then q ” based on the following information. Antecedent: Salamanders lives in water and on land. Consequent: Salamanders are amphibian. Answer:

4.4 Data Collections Procedures

In the beginning of the research process, students with high and low ability level in each class were identified by checking on their previous mathematics test results. This was to ensure that the students with low ability level would be given more attention during the lesson and to improve the students overall performance in the

class. One of the classes was assigned as the experimental group (using collaborative learning method) while the other class was assigned as the control group (using lecture-based method). A pretest (a standardized monthly test) was administered to both the experimental and control group. After the pretest was conducted, the treatment began. In the control group class, students were taught using the lecture-based method. In the treatment group, the class were taught using collaborative learning method where in the beginning of the class, students were asked to form a group of five students and they were given the freedom to choose their group members.

During the lesson, the class conducted a group activity where each group were required to solve a series of questions relating to the lesson by discussing among group members. Throughout the activity, the teacher acted as a facilitator, observing the students and aiding the students in their quests to solve of the questions. At the end the class, students from each group were asked to present their answers in front the class. Both classes were taught for four weeks with five periods of 40 minutes a week. At the end of the four weeks of interventions, a posttest that was similar in format and content to the pretest was administered. After answering the posttest, the students completed the questionnaire.

4.5 Data Analysis

Data obtained from the study were coded, computed and analyzed using the Statistical Packages for the Social Science (SPSS) version 14.0. The data were analyzed using Two-Way ANOVA and independent t-test.

5.0 RESULTS

As shown in Table 2, there were significant differences in the mean gain in mathematics achievement (posttest-pretest) between the classes taught using the two instructional methods ($F = 106.49, p < 0.005$). Referring to Table 3, students in the treatment group, using collaborative learning, had higher mean score for the mathematics achievements ($M = 56.765, SD = 14.401$) compared to those in the control group ($M = 18.971, SD = 13.750$).

Table 2 also showed that there were significant differences in the mean gain in mathematics achievement tests scores based on gender ($F = 11.581$, $p = 0.001$). Female students had higher mean gain in mathematics achievement test scores ($M = 43.265$, $SD = 21.974$) than male students ($M = 23.947$, $SD = 22.459$), as shown in Table 3. However, there was no significant interaction effects between gender and instructional approaches used ($F = 0.631$, $p = 0.430$).

Table 2 Two- way Analysis of Variables (ANOVA) results for the gain scores in mathematics achievement (pretest-posttest)

	Sum Squares	of df	Mean Square	F	<i>p</i> -value
Teaching Method	17982.681	1	17982.681	106.490	0.000
Gender	1955.606	1	1955.606	11.581	0.001
Teaching Method x Gender	106.496	1	106.496	0.631	0.430
Error	10807.498	64	168.867		
Total	37365.809	67			

Table 3 Means and standard deviations for the gain scores in mathematics achievement (pretest posttest)

		Gender		Total
		Male	Female	
Teaching Method	Traditional	9.167 (11.044)	24.318 (12.179)	18.971 (13.750)
	Collaborative Learning	49.286 (10.177)	58.704 (14.845)	56.765 (14.401)
Total		23.947 (22.459)	43.265 (21.974)	37.868 (23.616)

Note: The figures in bracket refer to standard deviations while the rests are means

As shown in Table 4, there were significant differences in students' interest in learning mathematics between the groups of students taught using the two instructional methods ($t = 3.364$, $p = 0.001$). Students in the treatment group using collaborative had higher interest in the lesson ($M = 2.26$, $SD = 0.711$) compared to those in the control group ($M = 2.81$, $SD = 0.629$).

Table 4 Independent t-test result for students' interest in learning mathematics based on teaching methods

		Mean	Standard Deviation	t	df	p-value
Interest	Traditional	2.805	0.629	3.364	66	0.001
	Collaborative Learning	2.257	0.711			

Based on Table 5, there were no significant differences in the students' interest in the subject based on gender ($t = 2.084$, $p = 0.067$).

Table 5 Independent t-test results for students' interest in learning mathematics based on gender

		N	Mean	Standard Deviation	t	df	p-value
Interest	Male	7	2.750	0.711	2.084	8.931	0.067
	Female	27	2.130	0.666			

Table 6 showed that there were significant differences in students' perceptions for the teaching methods between the groups of students taught using different instructional method ($t = 3.014$, $p = 0.004$). Students in the treatment group, using collaborative, had more positive perceptions for the teaching method ($M = 2.40$, $SD = 0.490$) compared to those in the control group ($M = 2.81$, $SD = 0.621$).

Table 6 Independent t-test results for students' perceptions based on teaching methods

		Mean	Standard Deviation	t	df	p-value
Perceptions	Traditional	2.810	0.621	3.014	66	0.004
	Collaborative Learning	2.397	0.490			

Based on Table 7, it was found that there were no significant differences in students' perceptions of collaborative learning in the teaching of the topic of Mathematical Reasoning based on gender ($t = 1.466$, $p = 0.174$).

Table 7 Independent t-test results for students' perceptions on the teaching methods based on gender

		N	Mean	Standard Deviation	t	df	p-value
Perceptions	Male	7	2.629	0.464	1.466	9.711	0.174
	Female	27	2.337	0.486			

Overall, it was found that students from the collaborative learning group had higher mathematical achievement gain scores (pretest - posttest), more positive views of the teaching method used and interest in the teaching mathematics than students taught in the lecture-based class. In addition, female students appear to outperform the male students in both classes. However, gender did not appear to influence students' positive perceptions of collaborative learning and both gender appeared to have high interest in mathematics in the collaborative learning class.

6.0 DISCUSSIONS

The findings indicated that students that were taught using collaborative learning had better gain scores in mathematics achievement tests compared to students that were taught using traditional instruction. This result supported Wilczenski, Bontrager, Ventrone, and Correia's (1999) research findings where they found out that more students from the collaborative learning group obtained accurate answer in the posttest compared to students who worked without group collaboration. Wilczenski et al. (1999) suggested that high mathematics achieving students were active participants and presumably influential in group interaction. This also supported Vygotsky's (1978) idea that students were capable of performing at higher intellectual levels when asked to work in collaborative situations than when working individually. Collaborative learning gave students important advantages not forthcoming with traditional instruction because a group (whether it be the whole class or a learning group within a class) could accomplish meaningful learning and solve problems better than any individual could alone (Tizman, Jones, Fennimore, Baker, Fine, & Price, 1990).

As for gender issues in collaborative learning, it was found that female students obtained better gain scores in the mathematics achievement test compared to male

students. However, the results contradicted those reported by Anastasi's (1958) study. According to Anastasi (1958), although differences in numerical aptitude favoured boys, the differences did not appear well until the elementary school year. Furthermore, if gender differences in computation did appear, they favoured females, whereas males excelled on tests of numerical reasoning.

It was found that there were no interaction effects between the teaching method and students' gender on gain score in mathematics achievement tests. This implied that the teaching methods used did not appear to be an advantage to certain gender. However, Rajagopal and Bojin (2002) reported differently. In their study, they found that there were significant interaction between gender and teaching styles and it was found out that most females experienced learning through peer interaction. Their result was also supported by Adedayo's (1999) study which similarly reported a significant interaction of instructional method and gender in which the most effective method for male students was the interactive method with group use of material, rather than individualized method. Female students on the other hand favoured the individual use of materials.

Based on the results of the study, it was found that there were no differences in students' interest in learning mathematics based on gender. Both gender had the same high interest on the use of collaborative learning in the teaching of mathematical reasoning. This result however contradicted Rajagopal and Bojin's (2002) findings. According to their study, it was found that girls seemed to have less interest in using computers for learning or for playing games at home and showed a greater anxiety in using computers, while boys were reported to show greater interest in new technologies.

There were no differences in students' perceptions on the teaching method based on gender. Both gender had the same high perceptions on the use of collaborative learning in the teaching of mathematical reasoning. This result was supported by Tiong and Yong's (2004) study, which reported that there were no significant differences in students' expectations and preferences towards collaborative learning based on their gender. The results of the study were also similar with those reported by Wu and Hiltz's (2004) study on online discussions. They reported that there were no differences between female and male students' perceptions of learning, motivation and enjoyment from online discussions.

It was found that students' in the collaborative learning class has high level of preferences toward the lessons compared to those in the traditional instructional class. Likewise, Pietsch (2005) reported that there were greater participations

among students in collaborative learning classes and this suggested that students' levels of critical thinking, self-regulation and help-seeking had increased. Gokhale's (1999) study, most students who participated in collaborative learning felt that it helped them to better understand the material, stimulated their thinking process and reduced the anxiety associated with problem solving, hence increased their interest in the lesson.

The result of this study was also supported by Edward and Jones' (2003) study. In their study, a random sample of seven students was chosen from:

- (a) a low attaining class of students aged 15-16 (known in the UK as Year 11 students) who had experienced small group collaborative work in mathematics for the previous four years,
- (b) a high attaining class of students aged 14-15 (Year 10 students) who had experienced small group collaborative work for the previous three years, and,
- (c) a middle attaining class of students aged 12-13 (Year 8) who had experienced two years of small group collaborative work.

According to Edward and Jones (2003), students realized the necessity of listening to one another; felt that collaborative working made them confident and successful and judged that they learnt mathematics more rapidly by working in that way. Similarly, Ruxue (2004) reported that mathematics was more fun and students' interest in mathematics increased when the students worked in collaborative groups.

7.0 CONCLUSIONS

Therefore, the results of the study, generally, indicated that collaborative learning is an instructional approach that could impact positively on secondary schools' learning of mathematics in Malaysian schools. Students in the collaborative learning class also appeared to have more interest in learning mathematics and have positive perceptions toward instructional method. Thus, although the study is limited by only using two intact classes and a single topic with the mathematics syllabus, the results showed that collaborative learning is an instruction approach

which had the potential to be implemented in the Malaysian secondary mathematics classes in tandem with other existing instructional approaches to create a more active, student-centred learning environment.

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APPENDICES

APPENDIX A: Questionnaire

Questionnaire No: Class: 

Faculty of Cognitive Sciences and Human Development
Universiti Malaysia Sarawak

INSTRUCTIONS

- Use a blue/ black pen or 2B pencil
- Please TICK LIKE THIS (/) ONLY

SECTION A: Background Questions

- Gender Male Female
- Religion Malay Chinese
 Indian Iban
 Bidayuh Others: _____
- PMR result for English A B
 C D
 E Others: _____
- PMR result for Mathematics A B
 C D
 E Others: _____

SECTION B: Students' Interest in learning Mathematics

	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
1. I like lessons in this subject.					
2. Lessons in this subject are fun.					
3. This subject is one of my favorite school subjects					
4. Lessons in this subject interest me.					
5. We should have more lessons in this subject each week.					

<input type="checkbox"/> <input type="checkbox"/> 6. I enjoy lessons in this subject.					
<input type="checkbox"/> <input type="checkbox"/> 7. I enjoy the activities that we do in this subject					
<input type="checkbox"/> <input type="checkbox"/> 8. These lessons make me interested in this subject.					

Section C: Students' Perception towards instructional method

	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
<input type="checkbox"/> <input type="checkbox"/> 1. I give my opinion during class discussion.					
<input type="checkbox"/> <input type="checkbox"/> 2. I explain my ideas to other students.					
<input type="checkbox"/> <input type="checkbox"/> 3. I am asked to explain how I solve problems.					
<input type="checkbox"/> <input type="checkbox"/> 4. I explain the meaning of statements, diagrams and graphs.					
<input type="checkbox"/> <input type="checkbox"/> 5. I solve problems by using information obtained from my own investigations.					
<input type="checkbox"/> <input type="checkbox"/> 6. When I work in groups in this class, there is teamwork.					
<input type="checkbox"/> <input type="checkbox"/> 7. I learn from other students in this class.					
<input type="checkbox"/> <input type="checkbox"/> 8. I am treated the same as other students in this class.					
<input type="checkbox"/> <input type="checkbox"/> 9. I receive the same encouragement from the teacher as other student do.					
<input type="checkbox"/> <input type="checkbox"/> 10. My work receives as much praise as other students' work.					