

The Effect of Mathematics Teacher's Teaching Method on Form Two Students' Mathematics Achievement

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ABSTRACT

The teaching methods used by teachers will determine the extent of student's performance in their academic. Teaching methods of mathematics include lecture, inductive, deductive, disclosure, problem solving and many more. Teacher may apply any strategies agreeing to unit of syllabus, accessible resource, and understudies in a course. When the teacher's teaching method is not clear, the student feels that mathematics is a difficult subject in school. This will affect not only their liking of mathematics, but their diligence, intrigue, boredom, and self-efficacy beliefs related to mathematics. Students who think mathematics is a hard subject tend to have low interest in learning mathematics. They will feel that mathematics is a boring subject and will not push themselves to understand it. This study examines the effects of teaching method used by mathematics teachers on the achievements of Form 2 student. Quantitative research design was used to collect data, selection of sample was carried using simple random sampling whereas questionnaire was applied as the research instrument. The respondents comprised of 240 students and 150 were chosen as the sample. There were three main concerns involved in this study, which are to identify any relationships between the teachers' student-centered teaching method and the students' interests in learning mathematics, the students' perception towards mathematics subject and the significant differences between the mean score of teacher-centered teaching method and student-centered teaching method for Form 2 students. The findings from this study revealed that teaching methods significantly affect student's achievements. Additionally, student-centered teaching methods and teacher-centered teaching methods were still relevant to improve student' academic performance.

Keywords: mathematics, student's achievement, student-centered, teacher-centered, teaching methods

INTRODUCTION

Mathematic skills have long been perceived as fundamental needs, not only for academic but also for an effective lifestyle. The significance of mathematics can be seen in many ways, all around us, for

example computers, coding, body scanners and many more. Without mathematics, curiosities about human greatest problems will not be able to be solved like how pyramids or skyscraper buildings been built. There are many types of teaching style that can be applied in teaching students. Teacher may apply any strategies which are suitable according to syllabus, accessible resources, and understudies in any course.

There are various types of student learning styles such as visual, auditory, kinesthetics and reading or writing (Xu, 2011). It should be noted that students in each classroom have distinctive abilities and consequently illustrate distinctive accomplishments. However, shockingly, in teacher-led instruction, all students are required to learn from the teacher within the same way at the same pace (Hwang et al. 2012). Sometimes students cannot follow the same pace for a certain topic, so the teacher needs to change their style of teaching for the topic.

According to Gurney (2007), teaching is considered successful and effective when students are being instructed with suitable content, having enough learning materials and high ratio of teachers' time on the teaching activity. If the teacher does not play effective roles to attract the students, students may set a bad perception towards mathematics, as a boring subject. When the lessons are not clearly delivered, students will feel that mathematics is confusing and difficult. Without doubt, most of the mathematics instructors highlight that the students' abilities of understanding mathematics are not strong since lower grades and the problems persist as they go to their higher grades. In other words, if their fundamental knowledge on the subjects is not adequate, they will certainly not be able to understand the advanced level. The time allocated for mathematics in the timetable also is insufficient to cover all the syllabus. Therefore, it is not easy for teachers to teach, in a limited time, when there are many students with different competencies in one class (excellent, moderate, and weak).

Kihwele and Mkomwa (2023) state that it is crucial to pilot the initiative in other schools to determine its contribution to promoting interest and achievement in mathematics. Teachers should be provided with motivation and capacity-building training to adopt and implement pedagogical innovations. Teachers and students should get the necessary support to improve mathematics performance. Future studies should first focus on implementing the initiative in more schools and assess its impact on promoting students' interests in learning mathematics and improving performance. Secondly, studies should aim at strategies to inspire more teachers to engage in pedagogical innovations and foster cooperation. The pedagogical innovation and collaboration will enhance teachers' continuous professional development to see them transform their classroom teaching practices.

This hence acts like a hint for teachers to realize that their teaching method will affect the student performance. If they plan wisely for the strategies to be implied in their teaching method, this will help to improve the student's achievement and may help to change their perception towards mathematics subject. This research will go deeper into the effect of mathematic teacher's teaching method on secondary students' mathematic achievement.

The hypothesis of this studies is as below:

H₀: There is no significant relationship between the teachers' student-centered teaching method and the students' interests in learning mathematics.

H₀: There is no significant difference between the mean score of teacher-centered teaching method and student-centered teaching method for Form 2 students.

The result from this study can be beneficial to better understand students' performance in mathematics via the various levels of mathematics achievement that they obtain. This study may also play an important role in enhancing students' understanding on mathematics at schools. Besides, the findings of this research would also be useful and valuable in educational setting, namely for teaching instructions, teaching approach, and students' evaluation in mathematics. Teachers should recognize

their students' perceptions towards mathematics to plan the best methods in teaching the subject. Teachers should also apply students' evaluation in a variety of ways in order to build a more constructive and positive perception towards mathematics. Having this objective achieved, students' mathematics performance will be enhanced regardless of any discipline they are majoring in. In addition, it is important to determine whether mathematics perception affects students' ability in mathematics, especially in problem solving skills. Students' perception towards mathematics is essential as it may influence the way they receive the knowledge and how they organize and define tasks at the cognitive level.

LITERATURE REVIEW

General Issues of The Research

Low quality teaching

Teachers, especially in Malaysia often seen to practice teacher-centered method in teaching. The students are required to copy exercises from whiteboards or exercise manuals, with minimum instruction given for the whole period of the lesson. Exercises were regularly restricted to exceptionally straight forward, 'yes' or 'no' question, and student were occasionally inquired to justify their answer or make a connection with other element of mathematics. Seldom discussions on mistakes were made, and usually they must figure out the solutions to any wrong question by themselves.

There are clearly teacher capacity confinements in this circumstance, meaning teachers may need essential content knowledge information or the vital academic content knowledge to verbalize compelling clarification when student struggle. In most cases, the teacher's pedagogical style may be basically reflecting the kind of training they received or the way they were instructed when they were in the school. But there are also possibilities that the teachers may not completely engage themselves in their work, which lead to their low-quality educating.

Students' perception towards mathematics

According to Conte (1991) and Zentall & Zentall (1983), mathematic anxiety and low confidence level in learning mathematics among students result in confused thinking, incompetence, low level of interest towards the subject, and non-participation in class. Students' attitude towards mathematics seems to be shaped by how they define mathematics in their mind and the importance that they attach to the role of mathematics in their life. A student who thinks mathematics is not important to his/her future life and work will not regard his/her mathematics course worthy enough to spend his/her valuable time on. For these students, their motivations to learn mathematics would be very low thus will result in the difficulty to learn mathematics meaningfully, Daud. et.al (2020). This is a serious issue and needs to be handled before situation becomes worse.

Student Centered Learning Approach

Zain et al. (2012) explored the effects of the student-centered learning (SCL) approaches in Mathematics on learning skills among pre-university students and teachers and the perception of the SCL technique in the course. The paper was conducted using mixed method approaches which are the combination of quantitative and qualitative research design to obtain the result. The paper has mentioned that the findings that were examined and discussed were in opposition to constructivism as the underlying philosophy. The result showed that student-centered learning increased students' collaboration and involvement both within and outside of the classroom, better lesson preparation, and certain skills demonstrated were all the examples of learning skills. The student will engage more, able to relate to their experiences, and become less passive in learning. The study also emphasized the discrepancy between what students believed they would learn and what the teacher taught, both in terms

of curriculum design and evaluation. In order to determine the purpose of this study, the paper has analyzed in terms of mean, median and mode.

It appears from the literature that some view student-centered learning as: the concept of the student's choice in their education; others see it as the being about the student doing more than the teacher (active versus passive learning); in addition, describes the shift in the power relationship between the student and the teacher (O'Neill & McMahon, 2005)

Student Perception Towards Mathematics Subject

The definition of attitude is a mental state or disposition, willingness to act, psychological underpinnings, acquired nature, and evaluative nature. When referring to attitude in the context of mathematics, it should be understood as a propensity to react favorably or unfavorably to mathematics. Davadas & Lay (2018), who carried out the study in 2018 used partial least squares and structural equation modeling to analyze how these elements interact and how that affects student's attitude about mathematics. The paper used quantitative methods which consist of four (4) types of questionnaires which are perceive parental influences, teacher affective support, classroom instruction, and attitude towards mathematics. The survey was conducted in Sabah, involving 318 students from Form 4. The study aimed to analyze the measurement the researchers use SPSS and for structure model using Smart PLS. Although the structural model's predictive usefulness is only fair, its components' linkages to one another are important. Results of this study show that parental effects was a weaker predictor of attitude toward mathematics than classroom teaching and emotional support from teachers.

Hwang & Son (2021) conducted a study to examine the students' attitude towards mathematics and how they related to academic success. The paper used latent profile analysis to identify four profiles of attitudes towards mathematics. Latent profile analysis uses a specific collection of variables, a latent variable technique focuses on locating latent subpopulations within a population. This study has found that students' attitude towards mathematics and mathematics achievement were positively correlated. According to these finding, the characteristics of students who are more likely to have high mathematics achievement are those who enjoy studying mathematics and engage in mathematics-related activities, those who think learning mathematics will have a positive outcome are those who have confidence in their mathematical skills.

Hagan et al. (2020) investigated how the students' attitudes about mathematics in Ghanian culture impact their academic success. The paper used descriptive survey design because descriptive survey is time efficient and can engage people at the center of research design by using questionnaire as the research tools. The respondents were chosen from the SHSs in the Kumasi area using a purposive selection technique made up the study's sample size to 297 students. Findings showed that students have good opinions on mathematics since they apply it in their daily life, despite a challenging subject it is.

Comparison of Teacher-Centered and Student-Centered Approach

Sunzuma & Maharaj (2020) study was to learn about the teachers' ways to teaching geometry as well as their opinions about the inclusion of ethnomathematics in geometry teaching. This study used a convergent mixed methods design as their approaches, while were questionnaire and focus groups were employed as data collection tools. A total of 40 pre-service mathematics teachers were selected as samples for this research. Finding demonstrates that the teacher-centered technique utilized by around 60% of pre-service mathematics teacher in the focus groups did not significantly include students in the teaching and learning process due to time constraints, inadequate knowledge of geometric topics, and the method that was taught. Meanwhile, student-centered techniques were consistent with the ethnomathematics approaches, which include tactics that would let students participate actively in

learning process, practice-oriented and project oriented. The result demonstrates that in teaching and learning of geometry, both teacher-centered and student-centered techniques were utilized.

In a single rural Arkansas delta school, ALE students progressively used a teacher-centered and a student-centered learning environment to compare their learning outcomes, Lancaster (2017). A mixed method methodology was used to compare the learning outcomes in the classroom settings. A student survey that was intended to gauge students' opinions and impressions of both setting and academic grades was one of the quantitative measures used. Classroom observation, semi-structured interviews, student focus groups, and diary entries were all used as qualitative research methods. A convenience sample from a group of alternatives students who volunteered to take part in the study was used by the lead researcher in this study. According to the survey findings, students who engaged in student-centered learning felt they had more input and choice, which in contrast to those who engaged in teacher-centered learning. Respondents in student-centered learning believed they had the chance to voice their thoughts and that the teachers need to care about their thoughts. Respondents said that learning environments focus on the student-centered provide more authentic and can expressed their real opinion.

Walberg's Theory

Walberg's (1981) theory of educational efficiency was experimentally tried as one of very few theories of academic achievement. Walberg's theory of academic achievement posits that mental characteristics of individual students and their prompt mental situations impact educational outcomes (cognitive, behavioral, and attitudinal) (Reynolds & Walberg, 1992). Further, Walberg's inquire about recognized nine key variables that impact educational outcomes such as student ability, inspiration, age or development level, amount of instruction, quality of instruction, classroom climate, home environment, peer gather, and introduction to mass media exterior of school (Walberg, Fraser, & Welch, 1986).

Analysts working on the evaluation of learning situation have also created and approved constructive-based, individual shapes of learning environment measures to tap students' individual, instead of collective perspectives of classroom life (Fraser, Fisher, & McRobbie, 1996). Learning environments have regularly been considered for the purposes of guaranteeing greatest student achievement in his or her education endeavors.

Inquiry about learning situations (Astin, 1993) shows that psychosocial characteristics of classroom learning situations illustrate incremental legitimacy in predicting student achievement. These psychosocial characteristics such as self-concept, states of minds, behaviors, inherent inspiration, and generally student engagement in learning are valuable in educational programs assessment thinks about and can provide instructors with valuable data to arrange more ideally functioning classrooms.

A conceptual framework shown in Figure 1 is an expository instrument with a few varieties and settings. It can be connected into numerous categories of work where an overall picture is required. It is utilized to create conceptual qualifications and organize thoughts. In this research, the conceptual framework acts as solid structure to reinforce the research topic. The conceptual framework comprises of the factors that the analyst would like to study and measure referring to the theory. Walberg's theory has been chosen as primary to understand towards the topic.

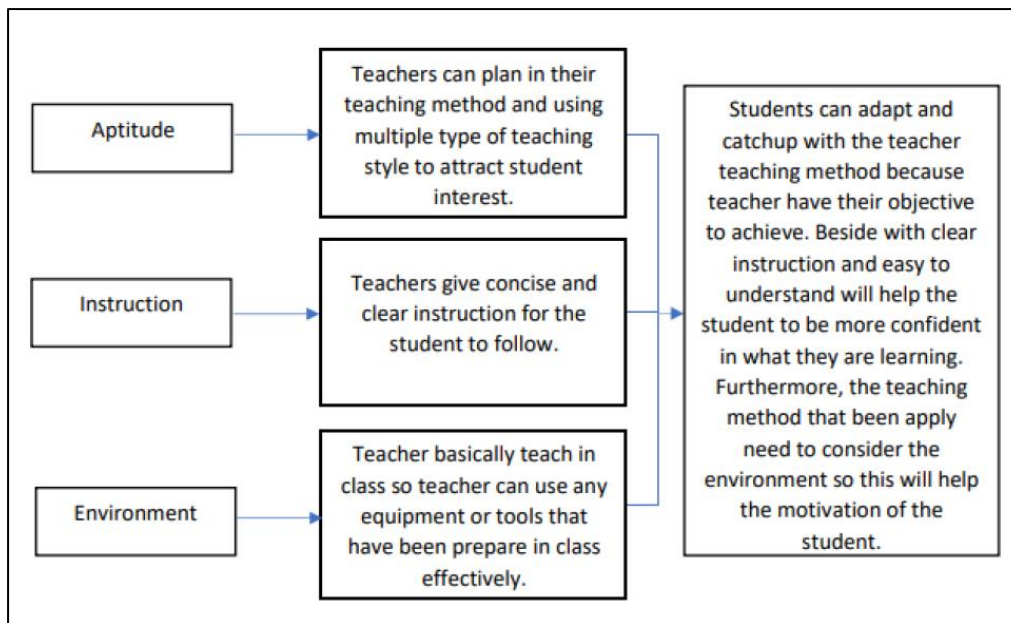


Figure 1: Conceptual Framework

METHODOLOGY

The research focused on the effects of mathematic teacher's teaching method on Form 2 students' mathematic achievement. Quantitative research design was used to collect data, selection of sample was carried using simple random sampling whereas questionnaire was applied as the research instrument.

Population

The target population for this research is secondary students (Form 2) from SMK Meru, Klang, Selangor, Malaysia, where the researcher is currently a practical teacher. SMK Meru also has the highest number of students. Moreover, there are about 240 students of Form 2 students in this school, which is lesser than targeted number; 150.

Sample and Sampling Procedure

A simple random sampling was used because there are 23 classes of Form 2 students in the school. This is a large population, thus a smaller sample size should be taken, to ensure higher accuracies. The whole sample procedure is summarized as in Figure 2.

Research Instrument

The instrument used was an online questionnaire (disseminated through Google Form). The questionnaire consisted of two sections: Section A and Section B. Section A comprised the demographic background of the respondents, while Section B consisted the questions on how teacher's teaching method affect their achievement, based on student's perception.

There were 20 questions in Section B. Some of the questions were 'true'/'false' or 'yes'/'no' and some were Likert scale. Likert scale is typically a five-point agreement scale to measure respondents' agreement with different statements. A sort of psychometric reaction scale in which

respondents specify their level of understanding to an explanation regularly in five focuses: (1) Strongly Disagree, (2) Disagree, (3) Natural, (4) Agree, (5) Strongly Agree.

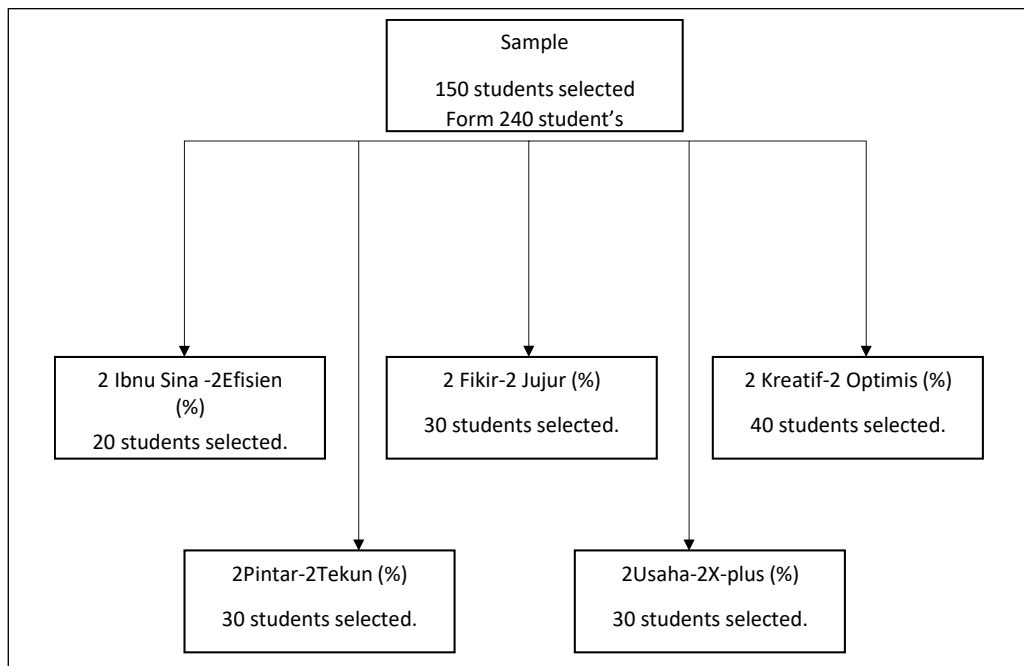


Figure 2: Sampling Procedure

RESULTS AND DISCUSSION

Spearman's Coefficient

The first research question was analyzed using Spearman's Coefficient to determine the relationship between the teachers' student-centered teaching method and the students' interest in learning mathematics. Based on the results from Table 1, the Spearman's Coefficient value shows that there is a weak relationship and significant relationship between the teachers' student-centered teaching method and students' interest in learning mathematics, $r = 0.258$, $n = 150$, $p < 0.05$. Thus, the null hypothesis was rejected.

Based on past research by Hamzah (2014), he found that 81% of students have a favorable opinion towards the student-centered approach and admit there are strongly positive relationship between student-centered approach and students' interest in learning mathematics. As compared to this current study, only 7% of the respondents were interested in learning mathematics when student-centered teaching method was used. This big gap might be caused by their demographic factor, where most respondents in the study done by Hamzah were for urban area, as contrast to ours, where most of respondents (54%) are staying in rural area.

However, we do not totally agree with the findings of past research because it solely relies on the students' interests. This is because, if a teacher uses other methods but the students themselves have no interest in learning mathematics, the teacher needs to find the method that is suitable to attract the student interest. By this it is clear that student interest is one of the factors that will depend on what method the teacher needs to use as long as the students get the benefits and achievement.

Table 1: The Spearman's Coefficient

	Students-Centered Teaching Method	Students' Interest
Students-Centered Teaching Method	Pearson Correlation	1
	Sig. (2-tailed)	.258**
	N	150
Students' Interest	Pearson Correlation	.258**
	Sig. (2-tailed)	1
	N	150

Descriptive Analysis

Descriptive analysis was used to analyze the students' perception towards mathematics subject. Refer to Table 2, the highest mean, 4.35 was achieved for the variable 'everybody needs mathematical knowledge' is 4.35. The results for descriptive analysis shows that students perception towards mathematics are mostly positive.. All kurtosis value are between -2 and 2, indicating all variables are normal.

Table 2: Descriptive analysis of Students' Perception towards Mathematics Subject

	Mean	Std. Deviation	Kurtosis	
			Statistic	Std. Error
Mathematics is important in our daily interactions.	4.26	.746	-1.071	.394
The topics in mathematics are easy to learn.	3.21	.848	.927	.394
I would like to pursue my studies in related to mathematics	3.21	.869	.394	.394
I rate mathematics equally high to all the other core subjects.	3.38	.974	-0.364	.394
Everybody needs mathematical knowledge.	4.35	.761	1.693	.394

This finding is like the previous research made by Hagan et al. (2020), who stated that students have positive perception towards mathematics even though they think it is a difficult subject. Since students are interested in the continuation of mathematics as a fundamental subject and the idea that everyone needs to study math, it is obvious that they have good perceptions on mathematics.

From the finding, it same as previous researcher which found that although students had a generally positive opinion of mathematics, the student knowledge of mathematics contrary with their perceptions. Perception alone is not enough if the students do not strive for success.

Paired Sample T-Test

Paired sample t-test was used to identify the significant differences between the mean score of teacher-centered teaching method and student-centered teaching method for Form 2 students. Referring to Table 3, Table 4 and Table 5, there is a significant difference between teachers' student-centered teaching method (mean = 3.997 and standard deviation = 0.566) and teacher-centered teaching method (mean = 4.068 and standard deviation = 0.642) with $t(149) = -1.48, p < 0.05$. Thus, the null hypothesis is fail and the alternative hypothesis is accepted.

Table 3: Paired Samples Statistics

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Student_Centered	3.9967	150	.56609	.04622
	Teacher_Centered	4.0683	150	.64174	.05240

Table 4: Paired Samples Correlations

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	Student_Centered & Teacher_Centered	150	.524	.000

Table 5: Paired Samples Test

Paired Samples Test										
		Paired Differences					t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
					Lower	Upper				
Pair 1	Student_Centered - Teacher_Centered	-.072	.593	.048	-.167	.024	-1.480	149	.141	

The results also show students agree that both of teaching methods are still relevant. From a researcher's perspective, to make sure that every student's benefits are met, it is essential for teachers to utilize a variety of strategies. This is because each teaching method has their own benefits and drawbacks. As in a teacher-centered, the classroom will be kept in order and all classroom activities can be completely monitored. Yet, students cannot express themselves, ask questions, or take charge of their own learning. For student-centered the students are allowed to have group interaction and active participation. The disadvantage of student-centered is when students are working in different phases of the same project, the teacher may have to try overseeing all of the students' activities at once, which will be very challenging.

This finding is coherent with the past research by Sunzuma & Maharaj in 2020, who also investigated both teacher-centered and student-centered. They focused on the topic of Geometry, and teaching method was found to be so relevant for this topic. However certain topics require student-centered teaching methods to attract the students, or activities need to be included, to improve the understanding. Hence, depending on the topics, the teacher may choose a suitable method that they may use. They may also apply mixed-methods, for example the first half hour of class the teacher may teach (teacher-centered), then another half hour, student-centered method could be used, making two-way teaching/learning process.

CONCLUSION AND RECOMMENDATIONS

The ways of teaching and learning Mathematics are complicated. This is due to the simultaneous effects of surrounding instructional activities and the environment in which the teaching process is being conducted. It is challenging to determine how to modify a particular teaching technique to improve

student's learning. There are many things that can be done besides focusing on the teaching method alone. For overview, all research findings supporting these guidelines are 1) the quality of learning among students will improve when their understanding of mathematical concepts, particularly on how the idea, concept, or skills are related to other mathematical concepts in various ways in a logically coherent and logical method are carefully emphasized. By establishing this conducive learning environment in the classroom, the interest of students toward mathematics may develop.

Besides, 2) giving students the chance to practice what they have learned as well as the chance to find and create new information can help to promote their progress. Teacher should frequently use non-routine problems, by occasionally introduce a lesson involving a new skill by farming it as a problem to be solved, and frequently allow students to build knowledge based on their intuitive knowledge and informal procedures in order to increase opportunities for invention.

This current study has a geographical and sample size limitation whereas it only focused on mathematics and involved only one level which are Form 2 students (all Malay) from SMK Meru. Therefore, the findings of this study can be used as references, specifically for this group only. For further studies, other subjects, level of students, and races should be considered. Additionally, only quantitative design was used to study the effect of teaching methods on students' mathematic achievement. Therefore, in future a research design based on qualitative design such as observation or interview is suggested, as researchers may be far more speculative about the topics they choose to look into when qualitative data collecting is being used.

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Rosly, N. S. directed the study and led in writing the manuscript. Mohd Radzuan, A. A performed the data analysis and findings and wrote the manuscript with the support of Ahmad, N. The research, analysis, and article were improved by all writers, who also offered constructive criticism.

CONFLICT OF INTEREST DECLARATION

I/We certify that the article is the Authors' original work. The article has not received prior publication and is not under consideration for publication elsewhere. This research has not been submitted for publication nor has it been published in whole or in part elsewhere. I testify to the fact that validity and legitimacy of the data and its interpretation for submission to Jurnal Intelek.

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