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EXPLORING STUDENTS' LEARNING STYLES AND MATHEMATICS PERFORMANCE AMONG LOWER SECONDARY SCHOOL STUDENTS

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Abstract:

Based on the result in TIMSS Mathematics Achievement 2019 for student grade 8, it shows that mathematics performance has not yet achieved the desired position in the Malaysia Education Blueprint (2013-2025). Furthermore, the average mathematics score reported by PISA 2022 in Malaysia declined by 31 points compared to the achievement in PISA 2018. The impact from this result will affects the quality of education in Malaysia compared to other countries. Students' academic performance may be reflected to some extent based on their learning styles. As such, it becomes useful information to guide teacher's instruction. Many studies have discussed on student learning styles; however, there are varying findings among different levels of learners. Therefore, this paper aims to investigate the learning styles and mathematics performance of lower secondary students (Form 1 and Form 2) in one of the schools in the Klang Valley by using cluster sampling. There were 147 respondents from Form 1 and Form 2 selected in this study. This study was conducted using a quantitative method; a set of VARK learning style questionnaire was distributed to the respondents, and mathematics performance results were taken from midterm test. The framework of the study adopted VARK learning style which has 30 items with seven dimensions that include visual, auditory, reading/writing, kinaesthetic, group and individual learning styles preference. The data analysed descriptive and inferential statistical techniques by using SPSS tool. The results revealed no significant difference in learning styles and mathematics performance between high and

low mathematics achiever. However, upon examining each learning style individually, it was found that high mathematics achiever students exhibited significant difference in their learning styles. Furthermore, the study found there is no relationship between students' learning styles and mathematics performance across both high and low mathematics achiever groups.

Keywords:

Learning Styles, VARK Learning Styles, Mathematics Performance, Secondary School

Introduction

Mathematics is an important subject that everyone must learn. Through mathematics, individuals develop certain qualities such as reasoning, creativity, critical thinking, problem-solving ability, and effective communication skills. In Malaysia, mathematics is a core subject that students should study from primary school until secondary school level. Mathematics is a branch of study interconnected with fields like engineering, science, and technology. Therefore, students need to be competent in mathematics in order to achieve the desired positions outlined in the Malaysia Education Blueprint (2013–2025).

The issues arise when the Organisation for Economic Cooperation and Development (OECD) reported a drop in the Programme for International Student Assessment (PISA) scores in Malaysia for the year 2022 across three main metrics: mathematics, reading literacy, and science. Unfortunately, the average mathematics score in PISA 2022 was 409 points, compared to 440 points in PISA 2018, indicating a decline of 31 points. Consequently, areas for improvement need to be identified.

Learning styles have been widely discussed in determining academic achievement across all fields of study (Chetty et al., 2019; İlçin et al., 2018). According to Anyamene et al. (2022), learning styles are features that describe a student's preferred method of learning, as well as instructional techniques that affect cognition, environment, and content of learning. Individuals learn differently using various methods, yet instructors may not always present information and learning experiences that align with their students' preferences. Discrepancies between teaching methods and students' learning preferences can lead to feelings of dissatisfaction among pupils and may cause poor performance (Chetty et al., 2019).

According to Neumann University (2019), there are various theories for categorizing learning styles, with Nel Fleming's VARK model being one of the most famous. Fleming modified the VAK model to the VARK model in 1987, classifying students into four different styles. The VAK model was introduced in 1979 to help students identify their learning styles. In the VARK model, learners are identified by whether they prefer visual (V), auditory (A), reading and writing (R), or kinaesthetic (K) learning.

Several studies have discussed learning styles and their impact on academic performance. In a study conducted by Anas et al. (2021) on the preferences for learning styles among undergraduate accounting students and their effect on academic achievement, it was found that the types of learning styles do not significantly influence students' academic performance. This could be attributed to the fact that each student employs different learning methods within their

academic discipline. Augustine et al. (2022), in their study among junior high school students, found that visual and kinaesthetic learning styles have a positive impact on learning related to ICT subjects. Furthermore, their study also revealed that visual, reading-writing, and kinaesthetic styles have significant positive impact on learning mathematics. In addition, a study conducted by Ariastuti and Wahyudin (2022) found that visual learning styles have a significant impact on academic performance when learning English subjects among undergraduate students. Therefore, we can see that students will use specific learning styles according to the field of studies.

Since mathematics is an essential subject, students in primary and secondary schools need to achieve a minimum level of proficiency in the subject. Mathematics can improve a person's capacity for critical thought and reasoning. If the student's level of mathematical literacy is below the national requirement, there will be negative consequences for both the individual and the nation. In light of the PISA 2018 and PISA 2022 findings on mathematics competency, it is critical to carry out more studies in this field. Furthermore, a considerable body of prior research has looked at how learning styles affect students' performance in mathematics at higher education levels. However, little is known about the learning styles of students in lower secondary schools, especially in Malaysia. Furthermore, PISA 2022 data showed that Malaysian grade 8 students' maths competencies are declining. Studies examining the connection between learning styles and academic achievement in mathematics - both for high and low achiever groups - are also few. It is important to expand this study to include lower secondary school students' learning styles and mathematics performance.

Within the context of this study, students from a lower secondary, who score highly or poorly in mathematics, are the main focus of the researchers' attention.

To achieve the aim of this study, the objectives are as follows:
a)   To examine the significant difference of student learning styles and mathematics performance between high and low mathematics achiever.
b)   To find the relationship between students' learning styles and mathematics performance between high and low mathematics achiever.

In order to support the research objectives, this study attempts to address the following research questions:
i.   What is the preferred learning style among lower secondary students towards mathematics?
ii.   Is there any significant difference of students' learning style and mathematics performance between high and low mathematics achiever?
iii. Is there any relationship between students' learning styles of mathematics performance with high and low mathematics achiever?

The next section discusses the related work on learning styles and academic performance, followed by methodology, results, and conclusions.

Literature Review
Mathematics is indeed an essential subject for everyone to grasp. In Malaysia, children are introduced to this subject from kindergarten and continue to study it through high school. A fundamental comprehension of mathematics empowers individuals to apply its principles in

their everyday lives. However, despite its early introduction, there is cause for concern regarding the decline of mathematics achievement following the post COVID-19 pandemic. As per the PISA 2022 scores in Malaysia, there has been a noticeable decrease in mathematics competencies among secondary school students. Since 2010, Malaysia has been actively participating in PISA, enabling it to monitor and assess the development of its educational system over time and compare it with other nations. This participation facilitates the acquisition of knowledge from the practices and policies of other countries, offering valuable insights for policymakers and educators.
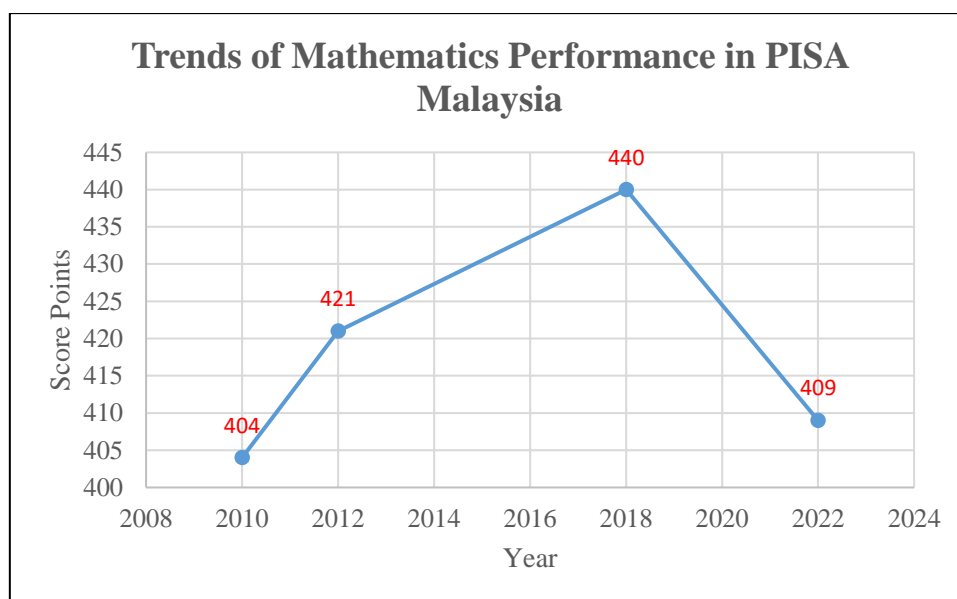
Figure 1: Trends of Mathematics Performance in Malaysia
Source: OCED (2023)

Figure 1 illustrates the trends in mathematics performance in Malaysia, as assessed by Programme for International Student Assessment (PISA) scores, spanning from 2010 to 2022. The PISA mathematics score exhibited a notable increase from 2010 to 2018. However, the PISA report for 2022 revealed a decline in mathematics performance, dropping by 31 points from 440 points in 2018 to 409 points in 2022. According to a study conducted by Hafizi (2020), several factors may contribute to this issue, including lack of self-confidence, negative attitude, deficiencies in problem-solving skills, ineffective learning styles and strategies, and lack of creativity in mathematics.

Therefore, this study aims to address the concept of learning styles. What is meant by learning style? It refers to "an individual's natural, habitual, and preferred way(s) of absorbing, processing, and retaining new information and skills" (Al-Roomy, 2023). Several learning styles models are outlined in Table 1.

Table 1: Learning Styles Model

Model	Author(s)	Dimension	Advantage	Disadvantage	Assessment Tool
VAK (1979)	Walter Barbe	Visual Auditory Kinaesthetic	Easy to categorize learner learning preference	Categorizing students based on a singular learning style	VAK questionnaire
Kolb (1984)	David Kolb	Diverging Assimilating Converging Accommodating	Improving learning process through learner experience	Difficulty in applying it to a group of learners	Learning Style Inventory (LSI)
VARK (1987)	Neil Fleming	Visual Auditory Read/Write Kinaesthetic	Helps learners and educator identify learning preferences and increase learning capabilities	Limited to one theory of learning styles	VARK questionnaire
FSLSM (1988)	Felder and Silverman	Active/Reflective Sensing/Intuitive Visual/Verbal Sequential/Global	More comprehensive description of students' learning preferences	Most suitable for educational technology	Index of Learning Styles (ILS)

There are three modalities of learning proposed by Walter Burke Barbe and his colleagues in 1979, who were educational psychologists. This model comprises three dimensions: visual, auditory, and kinaesthetic. One benefit of this model is its ease of application in identifying learners' preferences for learning styles. However, it is limited to a single type of learning style. Each individual is unique; they are not confined to one type of learning style but may have more than one preferred style of learning (Resmi, 2022).

The Kolb learning styles model, devised by David Kolb in 1984, consists of four dimensions: diverging, assimilating, converging, and accommodating. This model offers the benefit of enhancing learners' learning processes by experiential learning, thereby aiding them in becoming competent. However, educators may face difficulties in applying this model entirely. Accommodating all four dimensions within a group of learners can be challenging, given that each individual has their different learning style preference (De Figueiredo et al., 2022).

Hu et al. (2021) stated that Felder and Silverman established the Felder-Silverman learning style model (FSLSM) in 1988. This approach supports both traditional learning and the use of technology to improve the learning environment. One of this model's advantages is that it offers a thorough approach to individual learning, with eight categories of learners based on four dimensions. This approach is best suited for usage in computer-aided learning environment or e-learning environment.

One of the established and popular models used by researcher is VARK learning styles. VARK learning styles model was modified from VAK model. The VARK model was proposed by Neil Fleming in 1987. VARK is an acronym representing four types of learning styles: Visual (V), Auditory (A), Read/Write (R), and Kinaesthetic (K) (Subagja & Rubini, 2023). Learners with strong visual learning styles prefer illustrations such as charts, diagrams, and flowcharts. Aural learners prefer verbal modes such as explanations, discussions, and attending lectures. Read/Write learners prefer learning through words, typically by writing notes or reading. They often express their understanding through essays or explanations using words. Kinaesthetic learners prefer hands-on activities, such as experiments. The benefit of VARKS model is that it helps educators to utilize the VARK model in devising strategies for effective planning and fostering student learning according to their individual learning styles. Moreover, it acknowledges that students may possess multiple learning styles, rather than being confined to just one. However, the model is constrained as it focuses solely on the individual aspect of learning approaches and overlooks other crucial factors such as motivation, goals, and interests. (Harrington-Atkinson, 2022). A study conducted by Cabual (2021) mentioned that Neil Fleming's VARK model of learning should be utilized by educators before the beginning of class. It assists educators in tailoring their pedagogies to keep students engaged in the teaching and learning activities.

Table 2: Related Articles on Relationship between Learning Styles and Academic Performance

Articles	Authors (Year)	Findings	Level	Program
A study of the relationship of learning styles of undergraduate medical students to academic achievements	Khan, A. M. (2023)	No significant relationship between learning styles and academic performance	Undergraduate	Medical
Pupils' Learning Styles and Academic Performance in Modular Learning	Cavite and Gonzaga (2023)	No correlation between learning styles and academic performance among Grade IV, V and VI learners	High school	School
Correlation Between Learning Styles And Academic Achievement	Hidayah et al. (2022)	Positive relationship between learning styles and academic performance	Undergraduate	English
Relationship between Learning Styles and	Kouhan et al. (2021)	No correlation between learning styles and	Undergraduate	Nursing

Academic Performance among Virtual Nursing Students: A Cross-Sectional Study		academic performance. Dominant learning styles are kinaesthetic and auditory		
Learning Styles and Academic Achievement among Form Three Living Integrated Skills Students	Khan, M. R. (2021)	Significant correlation between learning styles and academic performance	Secondary school	Living Integrated Skills

Several studies have been conducted on the relationship between learning styles and academic performance. As indicated by Khan (2023), one such study revealed that the learning style preference of medical students is not correlated to their academic performance. Additionally, the study observed that many male students excel academically and favour unimodal learning styles, whereas female students tend to prefer bimodal learning styles. In a study by Hidayah et al. (2022), findings revealed a positive link between learning styles and academic performance among undergraduate students in the English Education Study Program. There are multiple factors that influence academic success; thus, educators should acknowledge students' learning styles. Another study by Kouhan et al. (2021) focused on undergraduate nursing students, categorizing them into weak and strong GPA groups to analyse the relationship between learning styles and academic achievement. Interestingly, there is no significant correlation found between learning styles and academic performance within these groups. Kinaesthetic (57.1%) and auditory (37.2%) are the most common learning styles among both groups. Vidyakala et al. (2019) noted that the correlation between learning styles and academic performance varies based on individual learning preferences. Cavite and Gonzaga (2023) found no notable distinction in academic performance concerning learning styles among Grade IV, V, and VI learners at Hindang Central School. Khan (2021) stressed the importance of learning styles in aiding teachers' lesson planning and execution while enhancing students' meta-cognitive abilities to learn in their preferred style. His study revealed a significant correlation between learning styles and academic performance. Thus, previous research indicates variations in the correlation between learning styles and academic achievement.

Based on Neil Fleming's VARK model, the conceptual framework of this study adopted the VARK model, including grouping and individual learning styles as independent variables. Meanwhile, mathematics performance is the dependent variable.

Methodology
The researcher completed the ethical clearance for the study which was granted by the Research Ethics Committee of Universiti Teknologi MARA (UiTM). Then, this study received permission from the school to distribute the questionnaire to the students.

A quantitative method was used to investigate students' learning styles and mathematics performance among lower secondary school students. Student who participates in this study has to complete the questionnaire after the school session and return it on the next day. The questionnaire comprises of two sections that correspond to the demographic variable and the learning styles preference of mathematics. The learning style preferences questionnaire

consists of 30 items by using the standardized methods of VARK. It was adopted from an article by Main (2022). The questionnaire used in this study consists of six subscales which are visual, auditory, reading/writing, kinesthetics, individual and group learning styles. The scoring point uses five-point Likert scale which ranges from "strongly disagree" to "strongly agree". Cronbach's Alpha was used to measure the reliability coefficient of the questionnaire, and it indicated good reliability ($\alpha = 0.822$). The midterm test was given to the lower secondary school students to answer it within one hour. The result from the test was used to measure the students' mathematics performance of this study.

The population of lower secondary school students in one of the schools in the Klang Valley in this study was 695. Cluster sampling was employed as the sampling technique. Data collected were primary data and the study's sample comprised 147 lower secondary school students. Form 1 participants were 74 students and Form 2 were 73 students, constituting approximately 21% of the population. The study was conducted between January 2023 until December 2023.

Statistical Package for Social Sciences (SPSS) version 23 tool was used to analyse the data. To achieve the objective of this study, data were analysed using descriptive and inferential statistics technique. The Kolmogorov-Smirnov test showed that the data are normally distributed for learning styles and not normally distributed for mathematics performance. Descriptive analysis (mean and standard deviation) was used to examine the preferred learning styles, while independent t-test was used to find the difference learning styles between low and high mathematics achiever. The Spearman-rank was used to determine the correlation between learning styles and mathematics performance. The strength of correlation was determined based on r value: between 0.00 – 0.19 (very weak), 0.20–0.39 (weak), 0.40–0.69 (moderate), 0.70–0.89 (strong) and 0.90 -1.00 (very strong) (İlçin et al., 2018).
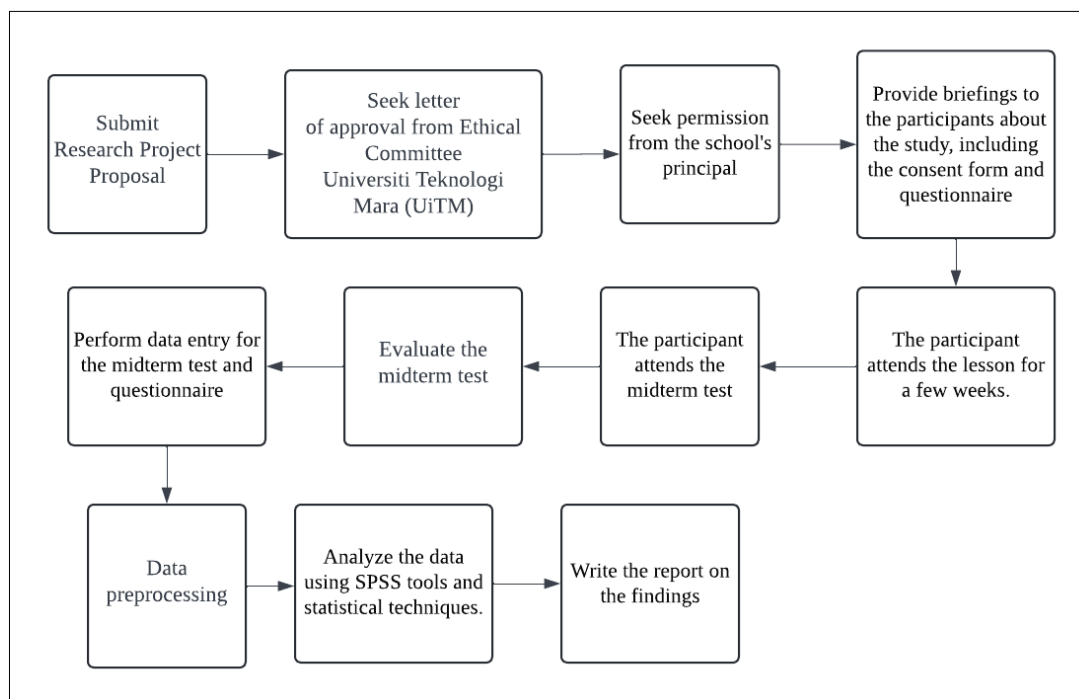
Figure 2: Process of Study

Figure 2 shows the research procedure of this study. There are several steps that have been taken before conducting the study.

Several challenges occurred during the data management of this study, one of which is getting permission from the appropriate authorities to collect respondent data because the respondents were under age. The researcher then obtained the complete set of data from the respondents because the questionnaire was printed, and they had to turn it in the next day. Lastly, data entry and raw data preprocessing must be done before the researcher starts the analysis.

Results and Findings

Research Question 1:
What is the preferred learning style among lower secondary students towards mathematics?

Table 3: The Level of Mean Score in Learning Style

Mean Score	Interpretation
1.00 – 1.80	Very Low
1.81 – 2.60	Low
2.61 – 3.20	Medium
3.21 – 4.20	High
4.21 – 5.00	Very High

Source: Moidunny (2009)

The source for this study as presented in Table 3 was adapted from Moidunny (2009). Interpretation level consists of five levels which are based on the mean score. It is used to identify the level of preference of the students' learning styles.

Table 4: Descriptive Statistics for Overall Learning Styles Preferred

Learning Styles	Mean	Standard Deviation	Interpretation
Visual	3.36	0.693	High
Auditory	3.54	0.654	High
Reading/Writing	3.34	0.745	High
Kinaesthetic	3.55	0.681	High
Grouping	3.80	0.696	High
Individual	2.93	0.876	Medium

Table 4 shows the overall preferred learning styles among lower secondary school students. From six types of learning styles observed, there are five learning styles interpreted as high while one learning styles is less preferred by students which is interpreted as medium. The most preferred learning style among the students is Grouping (Mean=3.80, SD=0.696) followed by Kinaesthetic (Mean=3.55, SD=0.681), Auditory (Mean=3.54, SD=0.654), Visual (Mean=3.36, SD=0.654), and Reading/Writing (Mean=3.34, SD=0.745). The less preferred learning style is Individual learning style (Mean=2.93, SD=0.876). Therefore, the student feels less preferred to study individually at this age level.

Research Question 2:

Is there any significant difference of students' learning style and mathematics performance between high and low mathematics achiever?

Table 5: Level of Mathematics Performance

Level	Score (%)
Low	0.0 – 49.9
Average	50.0 – 69.9
High	70.0 – 100.0

Table 5 shows that the level of mathematics performance is divided into three categories: low level with a percentage score between 0 and 49.9 percent; average level with a score ranging from 50.0 to 69.9 percent; and high level with a score between 70.0 and 100.0 percent. In this study, the researchers looked into high and low mathematics performance of their learning style after they have identified their preferred learning style. Moreover, the researchers wanted to know whether there is any significant difference of students' learning styles between high and low mathematics performance students.

Table 6: Overall Learning Style of High and Low Mathematics Achiever

		Levene's Test for Equality of Variances		t-test for equality of means				
		F	Sig	t	df	Sig. (2-tailed)	Means difference	Std. error difference
Preference Learning Styles	Equal variances assumed	2.063	.154	-1.658	111	.100	-.19131	.11542
	Equal variances not assumed			-1.966	40.908	.056	-.19131	.09732

Table 6 shows the overall learning styles between high and low mathematics achiever. The t-test result shows that there is no significant relationship (t=-1.658, df = 111, p >0.05). In general, there is no significant difference of students' learning styles between high and low mathematics achiever groups.

Table 7: Descriptive Statistics of High and Low Mathematics Achiever

Learning Styles	Mathematics Level	N	Mean	Std. Deviation
Visual	Low (<50)	91	3.34	.682
	High (≥70)	22	3.90	.541
Auditory	Low (<50)	91	3.51	.654
	High (≥70)	22	3.65	.650
Reading/Writing	Low (<50)	91	3.29	.749
	High (≥70)	22	3.61	.726
Kinaesthetic	Low (<50)	91	3.46	.629

	High (≥70)	22	3.85	.601
Grouping	Low (<50)	91	3.79	.659
	High (≥70)	22	3.95	.490
Individual	Low (<50)	91	2.84	.772
	High (≥70)	22	2.96	1.049

Table 7 shows the descriptive statistics between the learning styles of high and low mathematics achiever. The most preferred learning style of high mathematics performance is Grouping (Mean = 3.95, SD = .490) while the less preferred learning style is Individual (Mean = 2.96, SD = 1.049). The top three learning styles preferred by high mathematics achiever are Grouping (Mean = 2.96, SD = 1.049), Kinaesthetic (Mean = 3.85, SD = .601) and Visual (Mean = 3.90, SD = .541).

For low mathematics achiever, the top three learning styles preferred are Grouping (Mean = 3.79, SD = .659), Auditory (Mean = 3.51, SD = .654) and Kinaesthetic (Mean = 3.46, SD = .629). However, Individual learning style is less preferred by the students (Mean = 2.84, SD = .772). Therefore, there are two common learning styles preferred by high and low mathematics achiever in learning mathematics which are Grouping and Kinaesthetic.

Table 8: Learning Styles Between High and Low Mathematics Achiever

		Levene's Test for Equality of Variances		t-test for equality of means				
		F	Sig	t	df	Sig. (2-tailed)	Means difference	Std. error difference
Visual	Equal variances assumed	.998	.320	-3.593	111	<.100	-.562	.156
	Equal variances not assumed			-4.139	38.931	<.100	-.562	.136
Auditory	Equal variances assumed	.000	.985	.845	111	.400	-.131	.155
	Equal variances not assumed			.848	32.085	.403	-.131	.155
Reading/ Writing	Equal variances assumed	.010	.919	-1.828	111	.070	-.323	.177
	Equal variances			-1.863	32.682	.072	-.323	.174

		F	Sig	t	df	Sig (2-tailed)	Mean Diff	Std Error Diff
	not assumed							
Kinaesthetic	Equal variances assumed	.846	.360	-2.591	111	.011	-.384	.144
	Equal variances not assumed			-2.663	33.027	.012	-.384	.150
Grouping	Equal variances assumed	2.452	.120	-1.105	111	.271	-.166	.150
	Equal variances not assumed			-1.332	41.552	.193	-.166	.125
Individual	Equal variances assumed	2.932	.090	-.628	111	.531	-.124	.198
	Equal variances not assumed			-.522	26.755	.606	-.124	.238

Table 8 shows the six types of learning styles. It is used to determine the significant difference of each six types of learning styles between high and low mathematics achiever.

There are two types of learning style which found a significant difference between high and low mathematics achiever. Visual learning style indicates that there is a significant difference between students with high and low mathematics achiever since the p-value is less than 0.05 (t = -3.593, df = 111, $p < 0.001$). Meanwhile, kinaesthetic learning style produces t-test result (t= -2.591, df = 111, $p = 0.011$) that shows the p-value is less than 0.05. Thus, both types of learning styles have a significant difference between high and low achiever. High achiever student has a significantly higher preference of visual and kinaesthetic learning styles compared to the low achiever.

Meanwhile, the other types of learning styles are found to have no significant difference: Auditory learning style (t = 0.845, df = 111, p >0.05); Reading/Writing learning style (t = -1.828, df = 111, p >0.05), Kinaesthetic learning style (t =, df = 111, p >0.05), Grouping learning style (t = -1.105, df =, p >0.05) and Individual learning style (t =-.628, df = 111, p >0.05).

In general, the results indicate that there is no significant difference in students' learning styles between high and low mathematics achiever. However, when the study examined each type of learning styles individually, it was found that two types of learning styles show a significant difference between high and low mathematics achiever.

Research Question 3:

Is there any relationship between students' learning styles of mathematics performance with high and low mathematics achiever?

Tables 9 and 10 show the correlation between students' learning styles and mathematics performance of high and low mathematics achiever.

Table 9: Correlation Between Students' Learning Style and High Mathematics Achiever

	Visual	Auditory	Reading/ Writing	Kinaesthetic	Group	Individual
High Mathematics Performance	r= 0.115 p=0.609	r = 0.083 p = 0.714	r = 0.594** p = 0.004	r = 0.138 p = 0.542	r = -0.214 p = 0.339	r = 0.325 p = 0.140

Learning Styles

**Correlation is significant at the 0.01 level (2-tailed)

Table 9 shows the correlation between students' learning styles and high mathematics achiever. From the result analysis, it shows that there is a moderate positive correlation between high mathematics performance and reading/writing learning styles score (p <0.001, r = 0.594). No other significant correlation between high mathematics achiever and other learning styles was found. Thus, reading/writing learning style influences students to achieve high scores in mathematics.

Table 10: Correlation Between Students' Learning Style and Low Mathematics Achiever

	Visual	Auditory	Reading/ Writing	Kinaesthetic	Group	Individual
Low Mathematics Performance	r= 0.078 p=0.465	r = 0.124 p = 0.240	r = 0.138 p = 0.194	r = 0.024 p = 0.825	r = 0.029 p = 0.784	r = 0.179 p =0.090

Learning Style

**Correlation is significant at the 0.01 level (2-tailed)

The analysis result in Table 10 shows that there is no correlation between students' low mathematics achiever and learning styles. Therefore, low mathematics achievers are not dependent on any type of learning styles in learning mathematics. From the analysis found in Tables 9 and 10, there is a positive moderate relationship between reading/writing learning style and high mathematics achiever. Meanwhile, there is no relationship between learning style and low mathematics achiever.

Conclusion

The results of this study indicate that the most preferred learning style for learning mathematics among lower secondary school students is Grouping. Meanwhile, Individual learning style is

less favoured among the students. Therefore, teachers need to be creative in designing more activities that utilize the Grouping learning style during teaching and learning (T&L). At this level of age, the students are not yet fully prepared to learn mathematics independently. They still require assistance and guidance from their teachers and peers to comprehend the subject matter.

Based on the result analysis of differences in learning styles between high and low mathematics achiever groups, it was found that there is no significant difference between these two groups of students. However, an interesting finding among high mathematics performance students is a significant preference for subscale visual and kinaesthetic learning styles.

This study also explored the relationships between learning styles and mathematics performance among the two groups of students. The results found a moderately positive relationship of high mathematics achiever with reading/writing learning style. However, the results revealed that there is no significant relationship between learning styles and low mathematics achiever. Therefore, it appears that learning style is not a strong factor that can enhance mathematics performance.

The researchers' exploration of students' learning styles and mathematics performance has successfully achieved the aims and objectives of the study. The findings from this study are significant and impactful for educators, providing insights to enhance their teaching and learning strategies for students.

There are several limitations of this study which could be addressed in future research. One improvement could involve the increasing number of sample size. Additionally, investigating how students employ multi-mode learning styles in comparison to those with single-mode learning style could offer valuable insights of academic performance.

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