Relationship between Motivation Level and Mathematics Achievement Level for Form Four Students

Hubungan antara Tahap Motivasi dan Tahap Pencapaian Matematik bagi pelajar tingkatan empat

Muhammad Amin Sabri[1], Nurul Akmal Mohamed[2*], Nurul Huda Mohamed[3], Nurul Farihan Mohamed[4]

[1, 2,3]Department of Mathematics, Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris, 35900 Tanjong Malim, Perak, Malaysia
[2,3]STEM Nurturing Centre, Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris, 35900 Tanjong Malim, Perak, Malaysia
[4]Kolej PERMATA Insan, Universiti Sains Islam Malaysia, 71800 Nilai, Negeri Sembilan, Malaysia

*Corresponding author: akmal.mohamed@fsmt.upsi.edu.my

Diterima: 19 September 2024; **Disemak semula**: **0**6 Mac 2025 **Diterima:** 10 April 2025; **Diterbitkan:** 30 April 2025

To cite this article (APA): Sabri, M. A. ., Mohamed, N. A., Mohamed, N. H. ., & Mohamed, N. F. . (2025). Relationship between Motivation Level and Mathematics Achievement Level for Form Four Students. Jurnal Pendidikan Sains Dan Matematik Malaysia, 15(1), 83-95. https://doi.org/10.37134/jpsmm.vol15.1.7.2025

To link to this article: https://doi.org/10.37134/jpsmm.vol15.1.7.2025

ABSTRACT

This study aims to identify the types of motivation, specifically intrinsic and extrinsic among Form Four students in Mathematics. It also examines the relationship between these motivation levels and their achievement, particularly in the mid-year examinations. A descriptive correlational research design was used. The study focused on two main variables, i.e., students' motivation levels and their academic achievement in Mathematics. Using a cluster sampling method, the study targeted 150 Form Four students from a secondary school in the Tanjong Malim district, Perak. From this group, a sample of 30 students was selected, i.e., from one classroom. Data were collected using questionnaires and mid-year examination results. The data were then analyzed using the Likert Scale, descriptive statistics, and Pearson Correlation in SPSS version 29. The results showed that students had a moderate level of intrinsic motivation, with a mean score of 2.80. Whereas, their extrinsic motivation level was higher, with a mean score of 3.14. Overall, both motivation levels were categorized as high. The correlation analysis revealed a significant positive relationship between overall motivation and achievement ($r = 0.503$). This indicates that students with higher motivation tend to achieve better results in the subject. The correlation analysis gave a deeper understanding. Intrinsic motivation showed a strong and significant positive relationship with achievement ($r = 0.569$, $p = 0.001$). In contrast, extrinsic motivation showed only a weak and non-significant relationship with achievement ($r = 0.281$, $p > 0.05$). This suggests that depending on external rewards alone may not lead to higher performance.

Keywords: Student motivation, achievement, Pearson correlation, descriptive statistics, intrinsic motivation, extrinsic motivation

ABSTRAK

Kajian ini bertujuan untuk mengenal pasti jenis motivasi, khususnya motivasi intrinsik dan ekstrinsik dalam kalangan pelajar Tingkatan Empat dalam subjek Matematik. Kajian ini juga meneliti hubungan antara tahap motivasi ini dengan pencapaian pelajar, terutamanya dalam peperiksaan pertengahan tahun. Reka bentuk kajian

yang digunakan ialah kajian deskriptif korelasi. Kajian ini memberi tumpuan kepada dua pemboleh ubah utama, iaitu tahap motivasi pelajar dan pencapaian akademik mereka dalam Matematik. Melalui kaedah persampelan kelompok, kajian menyasarkan 150 pelajar Tingkatan Empat dari sebuah sekolah menengah di daerah Tanjong Malim, Perak. Daripada jumlah tersebut, seramai 30 orang pelajar telah dipilih sebagai sampel kajian, iaitu dari satu bilik darjah. Data dikumpulkan melalui borang soal selidik dan keputusan peperiksaan pertengahan tahun. Data tersebut dianalisis menggunakan Skala Likert, statistik deskriptif dan Ujian Korelasi Pearson dengan bantuan perisian SPSS versi 29. Hasil kajian menunjukkan bahawa pelajar mempunyai tahap motivasi intrinsik yang sederhana, dengan skor min sebanyak 2.80. Manakala tahap motivasi ekstrinsik adalah lebih tinggi, dengan skor min sebanyak 3.14. Secara keseluruhan, kedua-dua tahap motivasi dikategorikan sebagai tinggi. Analisis korelasi menunjukkan terdapat hubungan positif yang signifikan antara motivasi keseluruhan dan pencapaian (r = 0.503). Ini menunjukkan bahawa pelajar yang mempunyai tahap motivasi yang lebih tinggi cenderung untuk mencapai keputusan yang lebih baik dalam subjek tersebut. Analisis korelasi memberikan pemahaman yang lebih mendalam. Motivasi intrinsik menunjukkan hubungan yang kuat dan signifikan secara positif dengan pencapaian (r = 0.569, p = 0.001). Sebaliknya, motivasi ekstrinsik hanya menunjukkan hubungan yang lemah dan tidak signifikan dengan pencapaian (r = 0.281, p > 0.05). Ini mencadangkan bahawa bergantung kepada ganjaran luaran sahaja mungkin tidak membawa kepada prestasi akademik yang lebih baik.

Kata kunci: *Motivasi pelajar, pencapaian, korelasi Pearson, statistik deskriptif, motivasi intrinsik, motivasi ekstrinsik.*

INTRODUCTION

Mathematics education in Malaysia is compulsory from preschool through secondary school. The syllabus emphasizes concept acquisition and problem-solving. Student evaluation is carried out through tests, school examinations, and the Sijil Pelajaran Malaysia (SPM). Olivares et al. (2021) highlighted the importance of placing problem-solving at the center of the Mathematics curriculum. Olivares et al. (2021) suggested integrating mathematical concepts with real-world problem-solving to help students for better understanding. Maamin et al. (2022) stated that problem-solving in Mathematics must be grounded in core mathematical principles. Maamin et al. (2022) also indicated that it should also be connected to other mathematical topics. Implementing this approach in classrooms remains a challenge, even for countries like Singapore, which has made problem-solving a key focus in education. See (Toh et al., 2019).

Japan offers a successful example through the lesson study approach, which supports teaching through problem-solving (Schoenfeld & Kilpatrick, 2008). This method involves four phases i.e. the teacher presents a problem, students solve it individually, students then compare and discuss their solutions in groups, and finally, the class synthesizes the ideas together. According to Fujii (2018) and Isoda (2015), teachers in Japan carefully plan each lesson phase. This is to ensure students build strong mathematical understanding through active problem-solving.

Based on a study by Cahyaningsih et al. (2021), students may face challenges in understanding and solving problems when they lack mathematical resilience and metacognitive skills. This is often due to their grasp of the subject matter being evaluated leading them to rely on formulas they assume are correct, without verifying their solutions thoroughly. Yu & Singh (2018) claim that students' involvement and drive for success largely depend on their understanding of mathematical concepts. They also highlight that combining procedural knowledge with conceptual understanding across various areas helps students connect mathematical concepts and enhance their overall competency.

Academic achievement in each subject reflects a student's understanding of concepts, as shown through their test scores. Motivation is closely linked to performance in learning activities. According to Jeno et al. (2018), there are two strong positive predictors of academic achievement i.e. autonomous motivation and perceived competence. At the same time, Jeno et al. (2018) stated that autonomous motivation and perceived competence are also negative predictors of dropout intentions. Pohan et al. (2020) described motivation as a psychological process. This process motivates individuals to act to further achieve their goals, tailored to their specific needs, behaviors, and desired outcomes.

Abín et al. (2020) found that causal attributions can help explain students' actions. The causal attributions strongly affect both motivations, i.e., intrinsic and extrinsic, and academic achievement. Other than that, Abín et al. (2020) highlighted the important role of motivation in students' success in Mathematics. In addition, the research by Abín et al. (2020) also emphasized that teachers play a key role to strengthen students' conceptual understanding during the teaching and learning process in the subject of Mathematics.

This paper aims to explore the types of motivation, specifically intrinsic and extrinsic, among Form Four students in Mathematics. The main objective of our study is to find the relationship of these motivations levels with students' achievement in their mid-year examinations.

The study addresses three research questions as given below:

RQ1: What are the levels of intrinsic and extrinsic motivation among Form Four students in Mathematics?
RQ2: How do these motivation levels correlate with students' academic achievement in the subject?
RQ3: Is there a significant positive relationship between intrinsic and extrinsic motivations, with academic performance in the mid-year Mathematics examinations?

By answering the three research questions, we will provide a deeper understanding of the motivational factors that influence students' success in Mathematics.

LITERATURE REVIEW

According to Fiorella et al. (2021), motivation in Mathematics is essential for high school students. This is due to the fact that motivation plays an important role in promoting engagement, persistence, and success in STEM subjects. Fiorella et al. (2021) also stressed the importance of continuous efforts in order to help boost the students' motivation in Mathematics. A study by Kiwanuka et al. (2022) found that students' attitudes towards Mathematics were closely related to the students' academic performance in the subject. This study by Kiwanuka et al. (2022) was conducted among secondary school students in Central Uganda and showed that motivation and achievement influence each other. Therefore, the finding by Kiwanuka et al. (2022) implies that motivation is an important factor in improving Mathematics achievement.

In 2020, Suharti et al. (2020) reported a positive relationship between learning motivation and performance in Mathematics. Suharti et al. (2020) also suggested that students with higher motivation perform better in mathematical problem-solving. They also reported that motivated students are likely to be more persistent, confident when facing challenges, and enthusiastic in learning the concepts of mathematics. Although Suharti et al. (2020) did not consider specific levels of motivation and achievement, they acknowledged that other factors also contribute to students' academic performance. Hence, the other additional factors can also be considered in future research on Mathematics achievement.

Martínez-Ariza et al. (2022) found a significant correlation between intrinsic and extrinsic motivations. Hence, this finding by Martínez-Ariza et al. (2022) also indicates that both types of motivation, i.e., intrinsic and extrinsic motivations, play an important role in influencing students' academic performance in the subject of Mathematics. Also in 2022, Zebua et al. (2022) highlighted the importance of motivation in learning to improve Mathematics achievement. Zebua et al. (2022) emphasized that teachers should help their students by building students' motivation through providing positive feedback, setting appropriate challenges, and offering rewards. Their study also stressed the need for teaching strategies to enhance students' problem-solving skills. The teaching strategies include effective teaching methods and innovative learning models.

Hamidah and Safarini (2020) stated that students' interest in learning explained 16.4% of the variation in their ability to solve mathematical problems. The finding shows a meaningful relationship between interest in learning and problem-solving skills. However, they also found that 83.6% of the variation was influenced by other factors. The other factors included in Hamidah and Safarini (2020) are learning difficulties, lack of focus, and other external challenges.

Weidinger et al. (2020) explained that intrinsic motivation in Mathematics is linked to the enjoyment that the students feel when engaging in academic tasks. In contrast, utility value and achievement value refer to how important students believe Mathematics is for their future goals and personal success. Tran and Nguyen (2021) argued that intrinsic motivation is closely associated with academic success. Tran and Nguyen (2021) noted that extrinsic motivation is more complex. For example, external regulation drives behavior based on outside rewards or pressures. Introjection, however, comes from internal pressures, while identification reflects a deeper self-understanding and personal connection to learning. Tran and Nguyen (2021) also emphasized that motivation in Mathematics is strongly connected to achievement. In addition, they also stated that low motivation can negatively affect the learning process and overall educational experience.

Understanding students' motivation and achievement in Mathematics also requires us to look at demographic and psychological factors. In 2021, Shamsuddin et al. (2021) investigated the impact of gender and ethnicity on students' performance in specific Mathematics topics in Malaysia. However, they found no significant difference between male and female students. Shamsuddin et al. (2021) also noted that Chinese students scored higher on average than Malay and Indian students. Therefore, the finding suggests that cultural or environmental factors may influence student performance in Mathematics.

In another study related to psychological factors, Kuppusamy and Musa (2021) examined students' attitudes toward Mathematics in an international school. Their results showed a positive link between the attitude of the students and academic performance. Among all the attitude-related factors, self-efficacy had the strongest effect on how well students performed in their studies. Therefore, the finding by Kuppusamy and Musa (2021) indicates how importance of students' confidence in their abilities when learning Mathematics.

Both of these two studies i.e. by Shamsuddin et al. (2021) and Kuppusamy and Musa (2021) show that both background characteristics and personal beliefs play a role in Mathematics achievement. This finding supports the idea that motivation and attitude should be considered when planning teaching strategies that aim to improve student outcomes.

METHODOLOGY

This research is a quantitative study that used questionnaires to measure students' levels of motivation and achievement in mathematical problem-solving. A total of 150 Form Four students from six classrooms at Sekolah Menengah Kebangsaan Khir Johari (SMKKJ) were involved. From this group, a sample of 30 students was selected using a cluster sampling method. The sample size that we used was considered sufficient based on guidelines by Sekaran and Bougie (2016) and Guildford and Fruchter (1973). The guidelines by Sekaran and Bougie (2016) are useful because they recommend a minimum sample size of 30 for basic statistical analysis. This number is often used in research involving human behavior. Guildford and Fruchter (1973) also support this. They stated that a sample of 30 is enough to find patterns and relationships in social science studies.

Based on these references, the sample size in this study is suitable and acceptable for correlation analysis. Ethical standards were strictly followed. Informed consent was obtained from all participants. Their identities were kept confidential, and data were presented in aggregate form. The researchers

worked closely with the school principal, the Head of the Mathematics Committee, and the Mathematics teacher to coordinate this study.

Data were collected through a questionnaire distributed to students during school hours. Each student answered the questionnaire individually, without discussing with others. This was to make sure all answers were based on their own thoughts and not influenced by friends. The researcher was present in the classroom throughout the 30-minute session. Clear instructions and guidance were given, but the researcher did not interfere with the students' responses. This helped to avoid any bias during the data collection process.

Sampling was done using a cluster sampling method. Entire classrooms were chosen based on approval from school administrators. However, data were collected from each student as an individual. All procedures followed the official guidelines set by the Ministry of Education Malaysia, the Perak State Education Department, and the Muallim District Education Office. The students' information was kept confidential and only used for data analysis in this study.

Table 1: Likert Scale for Each Questionnaire Item

Score	Response
1	Strongly disagree
2	Disagree
3	Agree
4	Strongly Agree

To ensure the instrument's validity, the researchers sought evaluations from three experts: two lecturers from the Department of Mathematics at Sultan Idris Education University, and a secondary school mathematics teacher with over ten years of experience. The Content Validity Index (CVI) will be calculated, and a value of 0.78 or higher will indicate good validity (Polit et al., 2007).

A pilot study was carried out to test the questionnaire before the actual research. Baker (1994) suggests using 10–20% of the total sample size for a pilot study. Malhotra (2008) recommends using between 15 and 30 respondents. In this study, the pilot test involved 30 respondents, which meets both guidelines.

After evaluating the questionnaire, the data was analyzed using SPSS Version 29 to identify the relationship between the levels of motivation and achievement of Form Four students at SMKKJ. Descriptive statistics were used to find the frequency, mean, percentage, and standard deviation for each item. Before running the inferential analysis, a normality test was carried out to check if the data followed a normal distribution. The results showed that the data were normally distributed. Because of this, Pearson's correlation test was used to examine the relationship between the variables. The significance level was set at $p < 0.05$. The strength of the correlation was then interpreted using the scale suggested by Davies (1971).

Table 2: Scale for correlation strength between two variables (Davies,1971)

Coefficient Value	Description
0.70-1.00	Very High
0.50-0.69	High
0.30-0.49	Medium
0.10-0.29	Low
0.01-0.09	Ignored

Table 3: Determining the fairness of the mean score assessment for motivation level (Shaari et al.,2008)

Min Range	Level
3.01-4.00	High
2.01-3.00	Medium
1.00-2.00	Low

Table 4: Determining the fairness of the evaluation of the mean score for the level of achievement

Min Range	Level
7.01-10.00	High
3.01-7.00	Medium
1.00-3.00	Low

FINDINGS AND DISCUSSION

The pilot test, conducted at SMK Proton City on May 8, 2024, involved 30 Form Four students as respondents, with supervision by a Mathematics teacher. Data analysis using SPSS Version 29 showed that the Cronbach's Alpha coefficient was 0.879. This result is classified as excellent, indicating a high level of consistency (Bon & Fox, 2015). Based on the descriptive analysis of the students' mathematical motivation levels, the mean score obtained was 2.97, indicating a moderate level of motivation.

Table 5: The mean score for each item regarding the level of intrinsic motivation

No.	Items	SD		D		A		SA		Min Score	Standard Deviation
		f	%	f	%	f	%	f	%		
1	I like to solve complex math problems.	5	16.7	15	50.0	10	33.3	0	0	2.17	0.699
2	I feel happy when I get the right answer in math.	0	0	1	3.3	3	10.0	26	86.7	3.83	0.461
3	I was intrigued to learn the new basics of mathematics.	0	0	7	23.3	18	60.0	5	16.7	2.93	0.640
4	I like to find creative solutions to math problems.	2	6.7	13	43.3	12	40.0	3	10.0	2.53	0.776
5	I feel proud to be able to solve difficult math questions.	0	0	0	0	5	16.7	25	83.3	3.83	0.379
6	I like to try different approaches to solving math problems.	3	10.0	11	36.7	13	43.3	3	10.0	2.53	0.819
7	I feel inspired to achieve high academic goals in math.	0	0	1	3.3	19	63.3	10	33.3	3.30	0.535
8	I like to look for applications of	4	13.3	16	53.3	7	23.3	3	10.0	2.30	0.837

continued

	mathematical concepts in everyday life.										
9	I use math as a platform to unearth and show my creativity.	7	23.3	10	33.3	13	43.3	0	0	2.20	0.805
10	I was excited to find that mathematics is being applied in other fields such as science, economics, or technology.	4	13.3	11	36.7	14	46.7	1	3.3	2.40	0.770

SD : Strongly disagree D : Disagree A : Agree SA : Strongly Agree

Table 5 shows how students responded to items related to their intrinsic motivation in learning mathematics. The highest scores were found in Item 2 ("I feel happy when I get the right answer in math") and Item 5 ("I feel proud to be able to solve difficult math questions"), both with a mean score of 3.83. This suggests that students feel happy and proud when they succeed in mathematics. Item 7 ("I feel inspired to achieve high academic goals in math") also scored quite high, with a mean of 3.30. This shows that many students are motivated to do well in math because they have personal goals to achieve. However, some items received lower scores. For example, Item 1 ("I like to solve complex math problems") had a mean of only 2.17. Similarly, Item 9 ("I use math as a platform to unearth and show my creativity") scored 2.20. These results suggest that students are less interested in the challenging or creative parts of learning math.

Overall, the mean score for intrinsic motivation was 2.80, with a standard deviation of 0.45. This falls into the moderate range. It means that students show some level of interest and enjoyment in math, especially when they perform well. However, their inner drive to learn for reasons like curiosity or creativity seems to be less strong. This finding shows that teachers could focus more on making math lessons interesting and meaningful. Helping students enjoy solving problems and connecting math to real life might improve their intrinsic motivation.

Table 6: The mean score for each item regarding the level of extrinsic motivation

No.	**Items**	**SD**		**D**		**A**		**SA**		**Min Score**	**Standard Deviation**
		f	**%**	**f**	**%**	**f**	**%**	**f**	**%**		
11	I studied math because I wanted to achieve a high score on the exam.	1	3.3	16	53.3	13	43.3	0	0	3.40	0.563
12	I studied math because I wanted to receive physical rewards such as gifts or money.	6	20	16	53.3	8	23.7	0	0	2.07	0.691
13	I feel that my motivation to learn math increases when given attractive rewards.	0	0	8	26.7	20	66.7	2	6.7	2.80	0.551
14	I care about performance in math because it affects other people's perceptions of me.	0	0	7	23.3	14	46.7	9	30.0	3.07	0.740
15	I studied mathematics to meet the expectations set	0	0	2	6.7	15	50.0	13	43.3	3.37	0.615

continued

	by my parents, or teachers.										
16	I studied math because it provided me with the opportunity to secure a good job in the future.	0	0	1	3.3	12	40.0	17	56.7	3.53	0.571
17	I feel passionate about learning math when I see my friends succeeding in this subject.	0	0	4	13.3	14	46.7	12	40.0	3.27	0.691
18	I studied mathematics because it provided me with the opportunity to improve my family's standard of living.	0	0	1	3.3	24	80.0	5	16.7	3.13	0.434
19	I feel satisfied when I achieve the academic goals in math that have been set by my parents or teachers.	0	0	2	6.7	18	60.0	10	33.3	3.27	0.583
20	I need to learn math so I can show that I can do well in my lessons.	0	0	1	3.3	12	40.0	17	56.7	3.53	0.571

SD : Strongly disagree D : Disagree A : Agree SA : Strongly Agree

Table 6 shows the level of extrinsic motivation among Form Four students at SMKKJ. The overall mean score for extrinsic motivation was 3.14. This score is higher than the mean score for intrinsic motivation, which was 2.80. It suggests that students are more motivated by external factors than by personal interest in the subject. Items 16 ("I studied math because it provided me with the opportunity to secure a good job in the future.") and 20 ("I need to learn math so I can show that I can do well in my lessons.") recorded the highest mean scores, both at 3.53. These results related to these two items show that career goals and academic achievement are strong motivating factors.

Other items, such as Item 15 ("to meet expectations of parents or teachers") and Item 17 ("influenced by friends' success"), also scored high. These results indicate that students are also highly influenced by social expectations and peer performance. In contrast, Item 12 ("motivated by physical rewards like gifts or money") had the lowest mean score at 2.07. Item 13, which refers to attractive rewards, also showed a lower score of 2.80. These results of items 12 and 13 suggest that students are less likely to be motivated by material rewards. Overall, the findings show that students are more likely to be driven by long-term goals and external validation than short-term incentives. Teachers and parents can make use of this information to focus on meaningful encouragement and goal setting for the students, rather than offering them material rewards.

Table 7: Mid-year examination results for form four students

Grade	Clarification	Ordinal Scale	Number of Pupils	Percent (%)
A+	Highest Outstanding	10	0	0
A	High Outstanding	9	0	0
A-	Excellent	8	1	3.3
B+	Highest Honors	7	0	0
B	High Honors	6	0	0
C+	Top Honors	5	1	3.3

continued

C	Honors	4	3	10.0
D	Top Graduation	3	4	13.3
E	Pass	2	14	46.7
G	Failed	1	7	23.3
Total			30	100

We analyzed the data to obtain the mean score of mathematics achievement using SPSS Version 29 software. From the analysis, we then determined that the mean score of mathematics achievement was 2.40, with a standard deviation of 1.476. This led the researchers to conclude that the level of mathematics achievement for form four students at SMKKJ is comparatively low.

Table 8: Pearson correlation test results for the relationship between overall motivation (both intrinsic and extrinsic) and achievement

		Achievements	**Motivation Score**
Achievements	Pearson Correlation	1	.503**
	Significant (2-Ends)		.005
	N	30	30
Motivation Score	Pearson Correlation	.503**	1
	Significant (2-Ends)	.005	
	N	30	30

**. The correlation was significant at the 0.005 (2-end) stage.

The Pearson correlation test was then used to explore the relationship between overall students' motivation (both intrinsic and extrinsic) with their achievement in Mathematics. The results that we obtained showed a positive and moderate relationship between overall students' motivation (both intrinsic and extrinsic) and Mathematics achievement. This means that students with higher motivation often performed better in the subject. The Pearson correlation test showed that overall motivation has a moderate and positive relationship with Mathematics achievement. The correlation value was $r = 0.503$, with a significance value of $p = 0.005$. This means that students with higher overall motivation (both intrinsic and extrinsic) tend to achieve better results in the subject. However, as noted before, this result combines both types of motivation. Still, the finding in Table 8 suggests that motivation plays an important role in student performance in Mathematics.

We also extend the analysis by looking at each intrinsic and extrinsic motivation independently. These results highlight the importance of encouraging both types of motivation to help improve students' performance in Mathematics. The next two tables (Table 9 and Table 10) detailed analysis separating intrinsic and extrinsic motivation to fully understand on how each type is related to academic achievement.

Table 9: Pearson correlation test results for the relationship between intrinsic motivation and achievement

		Achievements	**Intrinsic Motivation**
Achievements	Pearson Correlation	1	.569**
	Significant (2-Ends)		.001
	N	30	30
Intrinsic Motivation	Pearson Correlation	.569**	1
	Significant (2-Ends)	.001	
	N	30	30

**. The correlation was significant at the 0.01 (2-end) stage.

The Pearson correlation analysis in Table 9 showed a correlation value of r = 0.569 between intrinsic motivation and mathematics achievement. This indicates a moderate and positive relationship. The significance value was p = 0.001, which is less than 0.05. This means the correlation is statistically significant. In other words, students who are more intrinsically motivated, those who enjoy learning math and feel satisfied when solving problems, tend to achieve better results. Based on this finding, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. There is enough evidence to confirm that intrinsic motivation is significantly related to mathematics achievement among Form Four students in the selected school in Tanjong Malim, Perak.

Table 10: Pearson correlation test results for the relationship between extrinsic motivation and achievement

		Achievements	**Extrinsic Motivation**
Achievements	Pearson Correlation	1	.281
	Significant (2-Ends)		.132
	N	30	30
Extrinsic Motivation	Pearson Correlation	.281	1
	Significant (2-Ends)	.132	
	N	30	30

The results from Table 10 show a weak positive relationship between extrinsic motivation and mathematics achievement. The Pearson correlation value is r = 0.281, with a p-value of 0.132. This means that students who are motivated by external factors, such as rewards or expectations from others, show slightly better performance in math. However, the relationship is not statistically significant at the 0.05 level. Since the p-value is greater than 0.05, the null hypothesis (H_0) cannot be rejected. In other words, this study does not find enough evidence to confirm a significant relationship between extrinsic motivation and academic achievement among Form Four students.

CONCLUSION

This study explored the levels of intrinsic and extrinsic motivation in Mathematics among Form Four students and how these factors relate to their academic performance. The findings showed that intrinsic motivation among students was moderate, with an overall mean score of 2.80. However, some items like “feeling happy when solving problems” and “feeling proud when answering correctly” had higher mean scores. This suggests that students do enjoy the learning process when they feel confident or successful. It also shows that emotional satisfaction plays a role in motivating students internally.

In contrast, extrinsic motivation had a slightly higher mean score of 3.14. Students reported being more driven by external rewards or expectations, such as approval from parents or the goal of securing a good job. Still, not all extrinsic factors were effective; for instance, rewards like gifts or money scored lower. This suggests that not all forms of external motivation are equally impactful. The correlation analysis added further insight. Intrinsic motivation had a strong and significant positive relationship with Mathematics achievement (r = 0.569, p = 0.001). This means students who are internally motivated tend to perform better. On the other hand, extrinsic motivation showed a weak and non-significant relationship (r = 0.281, p > 0.05). This implies that relying solely on external rewards may not lead to better academic outcomes.

When both types of motivation were combined into one overall score, the correlation with achievement remained significant and moderate (r = 0.503, p = 0.005). This supports the conclusion that motivation, especially intrinsic motivation, plays a key role in improving student performance in Mathematics. Hence, this study found that while Form Four students are moderately intrinsically motivated, they show slightly higher levels of extrinsic motivation. However, intrinsic motivation is more strongly linked to academic success. Therefore, it is crucial for educators and parents to nurture students’ internal interest and enjoyment in learning Mathematics, rather than relying only on rewards

or pressure. Encouraging curiosity, self-confidence, and pride in solving problems can help students develop a lasting and effective motivation to excel in the subject.

In conclusion, the study demonstrated that Form Four students exhibit moderate intrinsic motivation and relatively higher extrinsic motivation in Mathematics. This result answers our first research question concerning the level of each for the intrinsic and extrinsic motivations. The study also found that intrinsic motivation had a stronger positive correlation with mathematical achievement as compared to extrinsic motivation, which addresses our second research question. The study also confirmed a significant positive relationship between overall motivation levels and academic performance in mid-year Mathematics examinations. Lastly, we confirmed that intrinsic motivation had a strong and significant positive relationship with Mathematics achievement. While extrinsic motivation showed a weak and non-significant relationship. These results answer the third research question.

For future studies, it is suggested to use a larger sample from multiple schools. This would improve the generalizability of the findings. A longitudinal study design is also recommended to observe changes in motivation and achievement over time. Researchers are also encouraged to use qualitative methods such as interviews or focus group discussions. These suggestions can provide deeper insights on students' personal experiences as well as motivational factors.

Other further research that can also be considered is to compare motivation levels on different subjects other than mathematics. This may help identify whether specific subjects can encourage more of either intrinsic or extrinsic motivation. Other than that, gender-based analyses can be considered to identify differences in motivation and performance between male and female students. Besides that, future studies may also explore intervention-based designs. It is also suggested to test the effectiveness of the specific strategies to enhance motivation, such as reward systems or mentorship programs. In addition, we can also investigate the influence of either parents or teachers (or both) on students' motivation. Understanding these external factors can contribute to more holistic support for the teaching and learning process. Finally, it is also suggested that the relationship between motivation and mathematics anxiety be explored.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to Universiti Pendidikan Sultan Idris for the financial support provided through the Geran Penyelidikan Universiti Berteraskan Pendidikan (GPUBP), under the grant code 2022-0135-107-01. This support has significantly contributed to the successful completion of the research and has enabled the smooth execution of the work presented in this article.

REFERENCES

Abín, A., Núñez, J. C., Rodríguez, C., Cueli, M., García, T., & Rosário, P. (2020). Predicting mathematics achievement in secondary education: The role of cognitive, motivational, and emotional variables. *Frontiers in Psychology*, *11*, 876. https://doi.org/10.3389/fpsyg.2020.00876

Baker, T. L. (1994). *Doing social research* (2nd ed.). New York: McGraw-Hill.

Bond, T. G., & Fox, C. M. (2015). *Applying the Rasch model: Fundamental measurement in the human sciences* (3rd ed.). Routledge.

Cahyaningsih, U., Nahdi, D.S., Jatisunda, M.G., & Suciawati, V. (2021). Student's Mathematical Problem-Solving Ability with Mathematical Resilience And Metacognition Skills: A Quantitative Analysis. *Aksioma: Jurnal Program Studi Pendidikan Matematika*.

Davies, J. A. (1971). *Elementary survey analysis.* New Jersey: Prentice Hall.

Fiorella, L., Yoon, S. Y., Atit, K., Power, J. R., Panther, G., Sorby M.S., Uttal, D. H., & Veurink, N. (2021). Validation of the Mathematics Motivation Questionnaire (MMQ) for secondary school students. *International Journal of STEM Education*, *8*(52). https://doi.org/10.1186/s40594-021-00307-x

Guildford, J. P., & Fruchter, B. (1973). *Fundamental statistics in physiology and education* (5th ed.). New York: McGraw-Hill.

Hamidah, A. S., & Safarini, D. T. L. S. (2020). The relationship between students' learning interest and students' problem-solving skill of eighth-grade students in learning mathematics. *Research Journal of School Mathematics Learning*, *4*(2), 70-80.

Isoda, M. (2015). The science of lesson study in the problem-solving approach. In M. Inprasitha, M. Isoda, P. Wang-Iverson, & B.-H. Yeap (Eds.), *Lesson study: Challenges in mathematics education* (Vol. 3, pp. 81–108). World Scientific. https://doi.org/10.1142/9789812835420_0006

Jeno, L. M., Danielsen, A. G., & Raaheim, A. (2018). A prospective investigation of students' academic achievement and dropout in higher education: A Self-Determination Theory approach. *Educational Psychology.* https://doi.org/10.1080/01443410.2018.1502412

Kiwanuka, H. N., Van Damme, J., Van den Noortgate, W., & Reynolds, C. (2022). The temporary relationship between attitude toward mathematics and mathematics achievement. *International Journal of Mathematical Education in Science and Technology, 53*(6), 1546-1570.

Kuppusamy, S., & Musa, M. (2021). Investigating International School Secondary students'Attitude towards Mathematics. *Jurnal Pendidikan Sains Dan Matematik Malaysia*, *11*(2), 122-130. https://doi.org/10.37134/jpsmm.vol11.2.10.2021

Maamin, M., Maat, S. M., & Iksan, Z. H. (2022). The influence of student engagement on mathematical achievement among secondary school students. *Mathematics, 10(*1), 41. https://doi.org/10.3390/math10010041

Malhotra, N.K. (2008). Essentials of marketing: An applied orientation (2nd ed.). Australia:

Martínez-Ariza, L., Cudris-Torres, L., Echeverría-King, L. F., & Niño-Vega, J. A. (2022). Influence of motivation on academic performance: An analysis of motivational assessment in mathematics learning. *Journal of Research Development and Innovation, 12(*1), 57-66.

Olivares, D., Lupiáñez, J. L., & Segovia, I. (2021). Roles and characteristics of problem solving in the mathematics curriculum: A review. *International Journal of Mathematical Education in Science and Technology, 52*(7), 1079-1096.

Pohan, A. M., Asmin, A., & Menanti, A. (2020). The effect of problem-based learning and learning motivation on mathematical problem-solving skills of class 5 students at SDN 0407 Mondang. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, 3(1), 531-539. https://doi.org/10.33258/birle.v3i1.850

Polit, D. F., Beck, C. T., & Owen, S. V. (2007). Focus on research methods: Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Research in Nursing & Health, 30*(4), 459–467. https://doi.org/10.1002/nur.20199

Schoenfeld, A., & Kilpatrick, J. (2008). Toward a theory of proficiency in teaching mathematics. In D. Tirosh & T. Wood (Eds.), *The Handbook of Mathematics Teacher Education: Volume 2* (pp. 321–354). Brill Sense. https://doi.org/10.1163/9789087905460_016

Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill-building approach* (7th ed.). John Wiley & Sons. http://103.227.140.9/handle/123456789/18302

Shaari, A. S., Yusof, A. A., Khan, M. J., Tang, S. M., & Lim, K. T. (2008). Fairness of achievement assessment among teachers and its relationship with work motivation and school academic achievement. *International Journal of Management Studies (IJMS)*, *15*(9), 159-176.

Shamsuddin, H., Shamsuddin, J., Rabas, A. H., Abd Talib, N. N. S., Ismail, N. S., & Khairani, A. Z. (2021). The Effect of Gender and Ethnicity on Selected Topics in Mathematics among Secondary School Students. *Jurnal Pendidikan Sains Dan Matematik Malaysia*, *11*(2), 1-8. https://doi.org/10.37134/jpsmm.vol11.2.1.2021

Suharti, S., Muslim, A., & Sriyanto, S. (2020). The relationship between learning motivation and mathematics learning achievement of grade V students of SD Negeri Assisted Region 1 Sumbang Banyumas. *Madrasah: Journal of Basic Education and Learning.* http://ejournal.uin-malang.ac.id/index.php/madrasah/article/view/9662

Toh, T. L., Chan, C. M. E., Tay, E. G., Leong, Y. H., Quek, K. S., Toh, P. C., Ho, W. K., Dindyal, J., Ho, F. H., & Dong, F. (2019). Problem solving in the Singapore school mathematics curriculum. In T. Toh, B. Kaur, & G. Tay (Eds.), *Mathematics education in Singapore* (pp. 141–164). Springer. https://doi.org/10.1007/978-981-13-3573-0_7

Tran, L. T., & Nguyen, T. S. (2021). Motivation and mathematics achievement: A Vietnamese case study. *Journal on Mathematics Education, 12*(3), 449-468. http://doi.org/10.22342/jme.12.3.14274.449-468

Weidinger, A. F., Spinath, B., & Steinmayr, R. (2020). The value of valuing math: Longitudinal links between students' intrinsic, attainment, and utility values and grades in math. *Motivation Science, 6*(4), 413–422.

Weiner, B. (1986). *An attributional theory of motivation and emotion.* London: Springer-Verlag.

Yu, R., & Singh, K. (2018). Teacher support, instructional practices, student motivation, and mathematics achievement in high school. *The Journal of Educational Research, 111*(1), 81-94. https://doi.org/10.1080/00220671.2016.1204260

Zebua, A., Hendriana, H., Subandar, J., & Sugandi, A. I. (2022). The relationship between learning motivation with mathematical problem-solving ability in class XI students. *MaPan: Jurnal Matematika dan Pembelajaran, 10*(2), 312-322.