Students' Perceptions of Learning Mathematics at Pre-Diploma Level

Norfazillah Matmali[1*], Nur Aliyah Jazuli[2], Nasrah Naharu[1]

[1]*School of Mathematical Sciences, Universiti Teknologi MARA Sabah Branch, Kota Kinabalu Campus*
[2]*College of Computing, Informatics and Media, Universiti Malaysia Sabah*

ARTICLE INFO	ABSTRACT
	Pre-diploma students' performance in mathematics is a significant concern, impacting their academic progression and future career options. This study aims to identify key factors influencing the mathematical performance of pre-diploma students. Employing a quantitative descriptive survey design, this research examined the role of various factors, including student characteristics, instructional strategies, and institutional support. The findings revealed that lecturer influence, interest, and attitude significantly impact student performance. These results suggest that improving mathematics education at the pre-diploma level requires a holistic approach, considering not only student factors but also instructional strategies and institutional support. The implications of this study are discussed in relation to enhancing the teaching and learning of mathematics at the pre-diploma level.

INTRODUCTION

Universiti Teknologi MARA (UiTM) Kota Kinabalu Branch provides pre-diploma programs as a gateway for students having a Sijil Pelajaran Malaysia (SPM) certificate who may not have satisfied the full criteria for direct entrance into a diploma program. These programs equip students with the required foundation and abilities to succeed in their chosen diploma field. It provides a significant second opportunity for SPM graduates to continue their studies, particularly in diploma programs at UiTM. The program provides students with the academic understanding and practical skills required for success in their chosen diploma area. Students who complete the pre-diploma program will be entitled to apply for diploma programs provided by relevant faculties at UiTM, depending on their performance and program selections.

Existing research has identified several factors that can influence the mathematics performance of pre-diploma students at the tertiary level. One key factor is the level of

---

[1]* Corresponding author. *E-mail address*: norfa2340@uitm.edu.my

mathematical knowledge for teaching among pre-service teachers (Azizan et al., 2017). It has been shown that pre-service educators' mathematical views and learning opportunities have a major influence on their mathematical knowledge for teaching, affecting the instruction and assistance they provide students. Additionally, the roles of school principals, teachers, and parents have been found to be significant enabling or constraining factors for student mathematics performance in the primary education context (Abdullah et al., 2018).

Other significant factors that have been shown to influence mathematics achievement, especially at the secondary school level, include motivation, peer-assisted learning, and the quality of instruction. More motivated students who engage in peer-assisted learning and receive high-quality mathematics instruction tend to demonstrate better mathematics achievement. Diagnostic assessments are another tool that can help educators identify students' strengths and weaknesses in mathematics early on, allowing for more targeted instruction and support. This is especially important in the context of pre-diploma programs, where students come from diverse educational backgrounds and may need additional support to succeed in their mathematics courses.

The pre-diploma student population at UiTM Kota Kinabalu Branch is diverse in terms of academic background, socioeconomic status, and mathematical preparedness (Rahman et al., 2019). Prior research has identified a number of important variables that may affect university students' success in mathematics. These factors include students' interest and engagement in mathematics, their prior mathematical knowledge and preparation, socioeconomic status and access to learning resources. Identifying the key determinants of mathematics performance for this pre-diploma student cohort is crucial in developing targeted academic support and intervention programs to improve their mathematical abilities and overall educational success.

For university students to succeed academically and professionally, mathematics is an essential subject. From the very beginning to the most advanced levels of study, it is a topic that all students are required to understand. However, many challenges arise in mathematics education, particularly students' declining interest towards the subject (Bernido, 2020). The performance and engagement of university students in mathematics can vary greatly depending on their prior preparation and experience with the subject. Students who start university with a weak mathematics background sometimes struggle to stay up with more challenging curriculum, whereas those with a stronger foundation do better and participate more actively in their classes.

Therefore, the primary objective of this study is to identify and explore the factors that contribute to the mathematics performance of pre-diploma students at UiTM, Kota Kinabalu Branch. By gaining a deeper understanding of these factors, the study aims to inform the development of targeted interventions and support strategies to improve student outcomes in mathematics.

SIGNIFICANCE OF THE STUDY

The findings of this study will provide valuable information for educators, administrators, and policymakers at UiTM, Kota Kinabalu Branch. By understanding the specific factors that impact mathematics performance among pre-diploma students, targeted interventions and support systems can be designed to address the identified challenges and enhance student success. Moreover, the study outcomes may contribute to the broader conversation on improving mathematics education at the university level.

The significance of the study is underscored by the potential impact it can have on the academic support systems at the institution. By identifying the specific challenges and barriers faced by pre-diploma students in mathematics education, the study's findings can inform the development of tailored interventions and resources to enhance student success. Furthermore, the insights generated from this research may have broader implications for improving mathematics education in university settings. By addressing the factors that influence mathematics performance, the study outcomes could contribute to the ongoing conversation about enhancing the quality of mathematics education at the university level.

The study aimed to investigate the following research questions:

  i.   What are the perceived factors that influence the mathematics performance of pre-diploma students at UiTM, Kota Kinabalu Branch, as perceived by the students?

  ii. How do these perceived factors relate to the students' actual performance in MAT037?

By addressing these research questions, the study will contribute to a better understanding of the complex factors that influence mathematics performance at the pre-diploma level and provide valuable insights for educators and policymakers to enhance student learning and achievement.

FACTORS INFLUENCING MATHEMATICS STUDENT ACHIEVEMENT

The study found that interest, attitude, and lecturer influence play significant roles in students' performance in mathematics (Muda, 2017). Specifically, the analysis of interest revealed that students were satisfied when answering mathematics questions correctly but were less inclined to spend leisure time on mathematics exercises. The examination of attitude showed that students were attentive during learning sessions but were less likely to be proactive in seeking help or engaging in creative learning methods. The lecturer factor displayed high scores for attributes such as providing help, preparedness, professionalism, subject mastery, and clear communication, while creativity in teaching was rated at a moderate level. Additionally, the study highlighted the importance of addressing internal factors, such as students' attitudes and perceptions, to improve their learning experience and performance in mathematics. The study also emphasised the critical role of lecturers in influencing students' performance in mathematics, highlighting the need for engaging and creative teaching methods to enhance students' interest, attitude, and ultimately, their academic achievement in mathematics.

Attitude

Based on the findings of the study, the attitude of students towards mathematics has a significant impact on their academic performance. The analysis of attitude revealed that students were attentive during learning sessions but were less likely to be proactive in seeking help or engaging in creative learning methods (Moussa & Saali, 2022). This suggests that while students may be physically present and engaged in the classroom, they may not actively participate in the learning process or take the initiative to improve their understanding of the subject. To foster a more positive and proactive attitude towards mathematics, the study recommends implementing strategies that encourage students to take ownership of their learning, such as providing opportunities for self-directed exploration, peer-to-peer collaboration, and regular feedback from lecturers.

The findings align with previous research, which has consistently demonstrated the significant influence of attitude on mathematics performance (Boaler et al., 2021). The commitment and awareness of students towards mathematics tended to be high, with many students showing a willingness to make an effort and recognizing the importance of mathematics for their future (Etcuban et al., 2019). However, despite the overall moderate level of attitude, positive attitudes were still evident among students regarding the approach to learning mathematics (Orozco et al., 2020). Additionally, the research highlights the importance of addressing the affective domain, which includes attitudes, beliefs, and emotions, in mathematics education (Moussa & Saali, 2022). Developing positive attitudes towards mathematics is crucial for student success, as it can lead to increased motivation, engagement, and ultimately, improved academic performance.

Interest

Studies have shown that students tend to perform better in the subject when they have a high level of interest towards mathematics. This is because their interest and positive attitude motivate them to put in more effort, engage actively in learning, and better understand mathematical concepts.(Karlina et al., 2021) Interestingly, the findings of this study suggest that while students were satisfied with their performance in answering mathematics questions correctly, they were less inclined to devote their leisure time to practising mathematics exercises (Susanti & Hartono, 2018). This finding suggests that while students may have adequate academic interest in mathematics, they may not be translating that interest into regular practice and self-directed learning outside of the classroom.

However, the findings of the present study are consistent with previous research, which has also highlighted the importance of interest in influencing students' academic performance in mathematics (Saleem et al., 2023). Therefore, it is crucial for educators to foster a positive learning environment and promote strategies that enhance students' interest in mathematics.

Lecturer's Proficiency

The lecturer's proficiency and teaching approach plays a crucial role in influencing students' achievement in mathematics (Gunawan et al., 2021). The study found that despite the teachers' proficiency in the subject, students' results were not satisfactory, suggesting the presence of internal factors such as students' negative attitudes towards the teachers, which may have contributed to this outcome (Muda, 2017). The research also highlighted issues with the teaching approach used by mathematics lecturers, indicating that their methods were perceived as less engaging and creative, leading to a lack of interest among students in the subject (Twohill et al., 2022).

The study emphasised the need for various teaching strategies and approaches to address these issues, as they can significantly impact students' interest and commitment to learning mathematics. Additionally, multimedia and technology were identified as a potential means to enhance students' interest in mathematics. Therefore, the document underscores the importance of the teacher's proficiency and teaching approach in influencing students' achievement in mathematics and the need for innovative and engaging teaching methods to improve students' interest and performance in the subject.

METHODOLOGY

A quantitative research design incorporating a descriptive survey methodology was employed. Questionnaires were the only instruments used to collect data in this investigation. The information gathered for this research was analysed utilising SPSS version 26.0. The data is analysed in accordance with the requirements of the research queries at hand. The data used in

this investigation are quantitative. Descriptive analysis was employed to derive percentages and mean scores.

We will gather quantitative data through a survey administered to pre-diploma students at UiTM, Kota Kinabalu Branch. The survey will include questions related to previous academic performance, self-efficacy in mathematics, access to resources such as tutoring and study materials, and other potential influencing factors. The data collected from the survey will be analyzed using statistical methods to identify correlations and patterns.

Instrument

The questionnaire is utilized to collect the necessary information and data for this study. The rationale for choosing this instrument is that questionnaires are a prevalent research method employed in descriptive studies. Wiersma (1995) identifies this method as one of the most suitable approaches for investigations aiming to assess or quantify attributes such as attitude, perception, achievement, and involvement. Additionally, the descriptive form meets the study's objective of observing a phenomenon in action (Konting, 1990). The questionnaire that was developed was derived from several prior investigations that had been undertaken. This study incorporates the lecturer's factors and the student's attitudes and interests, which were modified from the research conducted by Muda (2017). The devised questionnaire is partitioned into two sections: Part A requests fundamental information from the respondents, while Part B examines the variables influencing mathematics achievement.

Sample

The researcher's target population for this study comprises the students enrolled in MAT037 semester Oct 2022- Feb 2023 at UiTM Kota Kinabalu branch. The researcher selected this population in order to examine the variables that impact these students' performance in mathematics. The study's demographic comprises 55 individuals who have completed the mathematics course. The present data was collected through a questionnaire investigation. Purposive sampling was employed as the sampling method. This is due to the fact that the participants of the study are exclusively mathematics-focused students. The sample size is ascertained using the Table of Determination of Sample Size, published by Krejcie and Morgan in 1970. The sample size determination table indicates that the overall study population is 55. The total number of participants in this investigation is 48.

Reliability Analysis

One of the most used dependability measurements in the fields of social and organizational sciences is Cronbach's alpha reliability (Cronbach, 1951). The dependability of a sum (or average) of q measurements, where the q measurements may reflect q rates, occasions, alternate forms, or questionnaire or test items, is referred to as Cronbach's alpha reliability. Cronbach's alpha is a measure of internal consistency reliability when the measurements represent several questionnaires or test items, which is a common application. A high value of alpha serves as an assurance against certain items being distinct in their ability to elicit response patterns that differ from those of other items (Cortina, 1993). Clark and Watson (1995) observed that the assessment of internal consistency reliability is complicated by the absence of clear standards for acceptable levels of Cronbach's alpha. Historial criteria have varied, with alpha coefficients previously considered acceptable at 0.80 or 0.90, but current standards have shifted to 0.60 or 0.70. Hence, Streiner (2003) presents a table of values that defines the importance of the calculated alpha value concerning internal consistency and reliability as shown in Table 1 below.

Table 1. Internal consistency value and significance (Cronbach's alpha)

	Cronbach's Alpha	Internal Consistency / Reliability Test
1	$\alpha \geq 0.9$	Excellent
2	$0.7 \leq \alpha < 0.9$	Good
3	$0.6 \leq \alpha < 0.7$	Acceptable
4	$0.5 \leq \alpha < 0.6$	Poor
5	$\alpha < 0.5$	Unacceptable

FINDINGS AND DISCUSSION

Forty-eight individuals from the entire population completed the questionnaire for this study. The participants in this survey are Pre-diploma Plantation students enrolled at UiTM Kota Kinabalu Campus. The items included in this section are to gather biographical information from the participants, including their gender and mathematics grade on the Secondary Assessment Certificate (SPM). In this investigation, 33 males (30.8%) participated as respondents, whereas 15 females (31.3%) were included. Meanwhile, the SPM grade of the respondent is illustrated in Figure 1. The diagram illustrates the SPM result of the respondent, which falls within the grades of C to E.
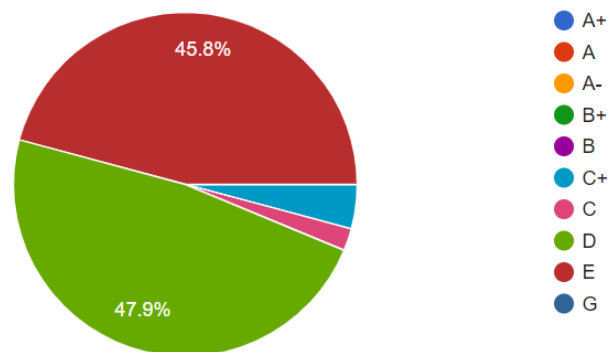

Figure 1. Mathematics grade on the Secondary Assessment Certificate (SPM)

Figure 2 presents the grade of Mathematics MAT037 (Intensive Mathematics). According to the data, grade C comprises the highest percentage in mathematics, at 19%. A mere 4% of the grade population is enrolled in grade D+. A grade is 15%, while A- grades indicate 6%. 19% of the respondents failed this examination.
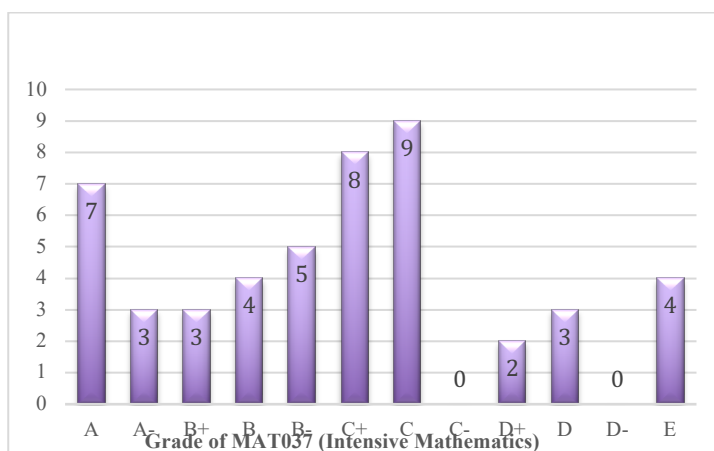
Figure 2. Grade of Mathematics MAT037 (Intensive Mathematics)

Interest

Mean score analysis is conducted to ascertain the elements that influence students' performance in Mathematics. A total of 21 items were assessed based on the variables outlined in the research. These items are measured using a Likert scale ranging from one to five points. Hence, the scale can be interpreted in terms of high (4.0 and above), moderate (around 3.0 to 4.0), or low (below 3.0). A high mean indicates a strong agreement with the statements, which means students tend to find the subject interesting and enjoyable. As for medium means, it suggests a neutral or moderate feeling; students may not dislike the subject but might not find it particularly interesting. Consecutively, a low mean signifies disagreement with the statement; students might find the subject uninteresting or even dull. This part has seven items pertaining to interest variables that respondents are required to answer. Table 2 displays the results of the descriptive analysis for the variables of interest.

Table 2. Variables of Interest

	Item	Mean	Standard Deviation (SD)	Mean Interpretation
(i)	Mathematics has always been my favourite subject since elementary school	3.42	0.942	Moderate
(ii)	Despite my lack of success in mathematics, I still find the subject interesting	3.65	1.000	Moderate
(iii)	Attending mathematics class excites me	4.25	0.758	High
(iv)	I feel satisfied when I answer Mathematics questions correctly	4.79	0.582	High
(v)	I enjoy solving mathematics problems	3.79	0.849	Moderate
(vi)	I practice my calculation skills whenever I have free time	3.42	0.964	Moderate
(vii)	I frequently complete mathematics exercises in my spare time, even when the lecturer does not explicitly ask me to	3.04	0.922	Low
	Mean	3.78	0.856	Moderate

The results of the descriptive analysis for variables of interest revealed means ranging from 3.04 to 4.79, indicating a generally positive interest in mathematics. Attending Mathematics class (Item 3) generated the most excitement, with a mean of 4.25, while practising calculation skills (Item 6) received the lowest response, with a mean of only 3.04. standard deviations around the means suggest some variation in student opinions, with a tighter range for satisfaction with the correct answers (Item 4) with an SD value of 0.582 and a more comprehensive range for practising calculation skills (Item 6) with an SD value of 0.964. The reliability analysis results are

shown in Table 3. The Cronbach's alpha for the scale is 0.776, indicating acceptable or good range of internal consistency (Cronbach's alpha = 0.776, n=7).

Table 3. Reliability Statistics for Interest

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Number of Items
0.776	0.762	7

Attitude

Next, for this part, students were required to respond to 7 items related to attitude factors. Similar to the previous section, a high value (4.0 above) indicates strong agreement with the statement, a moderate value (between 3.0 and 4.0) indicates moderate or neutral sentiment, and a low value (3.00 below) indicates disagreement with the statement. Table 4 shows the result of the descriptive analysis of the attitude factors.

Table 4. Attitude Factors

Item		Mean	Standard Deviation (SD)	Mean Interpretation
(i)	I paid attention during the lesson	4.35	0.699	High
(ii)	I jot down formulas when studying mathematics	4.38	0.789	High
(iii)	I have no trouble understanding mathematics lessons	3.42	1.069	Moderate
(iv)	I jot down brief notes as I revise for the mathematics subject	3.69	0.903	Moderate
(v)	I am always ready for mathematics lecture	4.38	0.733	High
(vi)	I am always in front of the class throughout the teaching and learning session	3.67	0.907	Moderate
(vii)	I always ask the lecturer if I have any questions about any mathematical problems or concepts	4.27	0.792	High
	Mean	4.02	0.842	High

The means for attitude factors in Table 4 ranged from 3.42 to 4.38, indicating commonly positive student attitudes towards mathematics learning. Students reported high agreement with attending lectures prepared (Item 5) with a mean value of 4.38 and SD value of 0.733 and paid attention during class (Item 1) with a mean value of 4.35 and SD value of 0.699. However, self-reported understanding lessons (Item 3), with a mean value of 3.42 and SD value of 1.069, and note-taking during revision (Item 4), with a mean value of 3.69 and SD value of 0.903 fell within the moderate range. Standard deviations suggest variations in student responses, with a broader range for understanding lessons and note-taking during revision. The reliability analysis results are shown in Table 5. The Cronbach's alpha for the scale is 0.770, which also indicates an acceptable or good range of internal consistency (Cronbach's alpha = 0.770, n=7).

Table 5. Reliability Statistics for Attitude

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Number of Items
0.770	0.775	7

Lecturer's Proficiency

The last part contains seven questions to be answered by students related to lecturer influence. Likewise, a score of 4.0 and above indicates strong agreement with the statements, a score of 3.0 to 4.0 indicates moderate sentiment, and any score below 3.0 indicates disagreement. Table 6 shows the findings from the lecturer's influence descriptive analysis.

Table 6. Lecturer's Influence

	Item	Mean	Standard Deviation (SD)	Mean Interpretation
(i)	My lecturer is always there to assist me in solving mathematical problems	4.81	0.673	High
(ii)	My lecturer did early and thorough preparation before our lessons	4.71	0.683	High
(iii)	My lecturer shows professionalism during the teaching and learning session	4.77	0.660	High
(iv)	My lecturer possesses expertise in the subject they teach	4.77	0.660	High
(v)	My lecturer's presentation is clear and easy to understand	4.73	0.676	High
(vi)	My lecturer gave exercises based on my skills/abilities	4.52	0.772	High
(vii)	My lecturer uses unique teaching methods to attract students' interest	4.48	0.799	High
	Mean	4.68	0.703	High

Based on the results in Table 6, students reported high agreement with all items (Item 1 to Item 7). However, agreement regarding exercises tailored to individual abilities, with a mean value of 4.52 and SD value of 0.772, and unique teaching methods, with a mean value of 4.48 and SD value of 0.799, fell below 4.60, slightly moderate compared to the others. Based on the analysis of these three factors, the average value of the mean score of the interest factor is 3.78, the attitude factor carries a 4.02 mean score, and the lecturer influence is 4.68. From the average mean score of these three factors, the lecturer influence variable is at the highest level, followed by attitude and interest factors. It can be concluded that the lecturer factor is the most dominant in this study. The reliability analysis results are shown in Table 7. The Cronbach's alpha for the scale is 0.951, indicating excellent internal consistency (Cronbach's alpha = 0.951, n=7).

Table 7. Reliability Statistics for Lecturer's Influence

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Number of Items
0.951	0.954	7

The results of the study point to several possible ramifications for raising university-level proficiency in mathematics. First, the study highlights how important lecturers are in affecting students' performance in mathematics and the necessity of innovative and captivating teaching strategies to improve students' interest, attitude, and, eventually, academic success in the subject. This implies that investing in professional development for lecturers to enhance their teaching approaches and strategies could significantly impact students' performance.

Additionally, the study underscores the importance of addressing internal factors, such as students' attitudes and perceptions, to improve their learning experience and performance in mathematics. This suggests the need for interventions aimed at fostering positive attitudes towards mathematics among students, potentially through targeted support programs or initiatives to enhance students' motivation and engagement with the subject.

CONCLUSION

The present study aimed to determine the perceived factors influencing the mathematics performance of pre-diploma students at UiTM, Kota Kinabalu Branch. The study provides insights into the use of multimedia and technology to enhance students' interest in mathematics, implying the potential for integrating innovative technological tools and resources into the teaching and

learning process. This could involve implementing interactive and multimedia-based learning materials to make mathematics more engaging and accessible for students. Overall, the implications of the study's findings suggest the importance of a holistic approach to improving students' performance in mathematics at the university level, encompassing both pedagogical enhancements and targeted interventions to address students' attitudes and perceptions towards the subject.

AUTHORS' CONTRIBUTIONS

Norfazillah Matmali carried out the research, conceptualised the central research idea, provided the theoretical framework, wrote the article. and approved the article submission. Nur Aliyah Jazuli designed the research, supervised research progress and wrote analysis part; Nasrah Naharu wrote introduction part, review, and revised the article.

REFERENCES

Abdul Rahman, M. N., Syed Zamri, S. N. A., & Leong, K. E. (2019). Modelling Opportunities to Learn, Mathematical Belief and Knowledge for Teaching among Pre-service Teachers. Eurasia Journal of Mathematics, Science and Technology Education, 15(7), em1724. https://doi.org/10.29333/ejmste/106228

Abdullah, N. A., Shahrill, M., Yusof, J., & Prahmana, R. C. I. (2018). Identifying the Factors Affecting Students' Performances in Primary School Mathematics. Journal of Physics: Conference Series, 1097, 012137. https://doi.org/10.1088/1742-6596/1097/1/012137

Azizan, F. L., Ahmad, N. A., Rahim, N. F., Daud, R., Samani, M. C., Zailani, M. A., Mustapha, M. A., Bukhori, M. F. M., & Kamal, A. A. (2017). Factors that Influence Program Selection and Its Relationship with Students' Achievement in Pre-University Study. Asian Social Science, 13(9), 145. https://doi.org/10.5539/ass.v13n9p145

Bernido, R., (2020). Guided Inquiry-Based Learning of Trigonometric Identities PEOPLE: International Journal of Social Sciences, 5(3), 767-781, Forthcoming, Available at SSRN: https://ssrn.com/abstract=3534696 or http://dx.doi.org/10.2139/ssrn.3534696

Boaler, J., Dieckmann, J. A., LaMar, T., Leshin, M., Selbach-Allen, M., & Pérez-Núñez, G. (2021). The transformative impact of a mathematical mindset experience taught at scale. Frontiers in Education, 6. doi:10.3389/feduc.2021.784393

Capuno, R., Necesario, R., Etcuban, J. O., Espina, R., Padillo, G., & Manguilimotan, R. (2019). Attitudes, Study Habits, and Academic Performance of Junior High School Students in Mathematics. International Electronic Journal of Mathematics Education, 14(3), 547-561. https://doi.org/10.29333/iejme/5768

Clark, L. A., & Watson, D. (1995). Constructing validity: Basic issues in objective scale development. Psychological Assessment, 7(3), 309–319. https://doi.org/10.1037/1040-3590.7.3.309

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. Journal of Applied Psychology, 78(1), 98–104. https://doi.org/10.1037/0021-9010.78.1.98

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16, 297–334. https://doi.org/10.1007/BF02310555

Gunawan. I, Nurhayati, L. W., & Hendrawan, B., (2020). Mathematical Proficiency Profile of Prospective Mathematics Teacher Students, J. Phys.: Conf. Ser. 1764 012109, DOI 10.1088/1742-6596/1764/1/012109.

Karlina, T., Saltifa, P., & Sari, R. K. (2021). The correlation between learning interest and mathematics achievement in grade VII SMP PGRI Bengkulu. Journal of Physics. Conference Series, 1731(1), 012051. doi:10.1088/1742-6596/1731/1/012051

Konting, M. M., (1990). Kaedah Kajian Pendidikan. (Methods in Educational Research). (pp. 599) Kuala Lumpur: Dewan Bahasa dan Pustaka.

Krejcie, R. V., & Morgan, D. W. (1970). Determining Sample Size for Research Activities. Educational and Psychological Measurement, 30(3), 607-610. https://doi.org/10.1177/001316447003000308

Moussa, N. M., & Saali, T. (2022). Factors Affecting Attitude Toward Learning Mathematics: A Case of Higher Education Institutions in the Gulf Region. Sage Open, 12(3). https://doi.org/10.1177/21582440221123023

Muda, W. H. (2017). Faktor-Faktor Yang Mempengaruhi Pencapaian Pelajar Dalam Matematik Di FPTV UTHM. Retrieved from ResearchGate:https://www.researchgate.net/publication/318307329_FAKTOR-FAKTOR_YANG_MEMPENGARUHI_PENCAPAIAN_PELAJAR_DALAM_MATEMATIK_DI_FPTV_UTHM

Orozco, G. M., Villanueva, J. C, Mejía, F. A., Obredor, S. C., & Silvera, E. M., (2020), Factors that promote positive attitudes towards mathematics in higher education students, J. Phys.: Conf. Ser. 1514 012027, DOI 10.1088/1742-6596/1514/1/012027.

Saleem, T., Durrani, R., & Malik M., (2023). A Study of Secondary School Students'Attitude Towards Mathematics in Tehsil Taxila. Vol. 9 No. 1 (2023): International Journal of Innovation In Teaching And Learning (IJITL). DOI: https://doi.org/10.35993/ijitl.v9i1.2388.

Streiner, D. L. (2003). Starting at the beginning: An introduction to coefficient alpha and internal consistency. Journal of Personality Assessment, 80(1), 99–103. https://doi.org/10.1207/S15327752JPA8001_18

Susanti, E., & Hartono. (2018). The perception of junior high school students in sleman on mathematics and creativity. Journal of Physics. Conference Series, 1097, 012097. doi:10.1088/1742-6596/1097/1/012097

Twohill, A., NicMhuirí, S., Harbison, L. & Karakolidis. A., (2023) Primary Preservice Teachers' Mathematics Teaching Efficacy Beliefs: the Role Played by Mathematics Attainment, Educational Level, Preparedness to Teach, and Gender. Int J of Sci and Math Educ 21, 601–622. https://doi.org/10.1007/s10763-022-10259-5

Wiersma, W. (1995). Research methods in education: An introduction. Boston: Allyn & Bacon.