



Students' perceptions of Symbolab and their associations with motivation and mathematics performance

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ARTICLE INFO

Article history:

Received 7 July 2026

Revised 5 September 2026

Accepted 12 September 2026

Published 30 September 2026

Keywords:

Symbolab

User experience

Perceived usefulness

Motivation

Mathematics learning

DOI:10.24191/ijms.v11i2.24253

Citation in APA:

Ting, S.U., Julaihi, N. H., Kelvin Goh, T. Y., Kanyang, A., & Christina Eu, N. L. (2026). Students' perceptions of Symbolab and their associations with motivation and mathematics performance. *International Journal of Service Management and Sustainability*, 11(2), 31 – 46.

ABSTRACT

The integration of digital learning tools in mathematics education has rapidly increased. It provides support to students' understanding and engagement in mathematics problem-solving. This study explores the students' perceptions of Symbolab and examines the associations between user experience, perceived usefulness, motivation, and performance in mathematics. A quantitative research design was employed, involving 86 part 1 students from the Diploma of Science programme at UiTM Sarawak. Data were collected using a structured questionnaire and analysed using descriptive statistics, Pearson correlation, t-test and multiple regression analyses. The results indicate that students generally reported positive perceptions of Symbolab in terms of user experience, perceived usefulness, and motivation. Correlation analysis revealed strong positive correlations between user experience and perceived usefulness, user experience and motivation, as well as user experience and motivation. However, t-test results showed no significant differences between students with and without an SPM Additional Mathematics background. Multiple regression analyses further indicated that both user experience and perceived usefulness significantly predicted students' motivation, with perceived usefulness emerging as the stronger predictor. The findings suggest that more positive user experiences and higher perceived usefulness were associated with higher levels of motivation among the students. The study highlights the potential value of digital mathematics tools such as Symbolab as complementary resources in mathematics education and provides insight into the factors associated with students' motivation and mathematics performance when using digital learning tools.

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1. INTRODUCTION

Mathematics is globally recognised as one of the most challenging subjects across all levels of education. The complexity of mathematical concepts, which involve a cumulative learning structure, often leads students to experience cognitive overload, mathematics anxiety, and poor academic performance. These challenges are increasingly evident in Malaysia's higher education following the implementation of the *Kurikulum Standard Sekolah Menengah* (KSSM), which introduced a more flexible subject package approach and broadened access to STEM-related programmes in higher education (Academy of Sciences Malaysia, 2023). Consequently, universities, including Universiti Teknologi MARA (UiTM), revised their admission requirements. Beginning in October 2022, the Diploma in Science (AS120) programme has admitted students without a pure science background (Jula'hi & Mohamadin, 2024). While this policy promotes equitable access to higher education and aligns with Sustainable Development Goal 4 (Quality Education), it has increased the diversity of students' academic preparedness. As a result, many students experience difficulties in foundational science courses and Calculus due to a lack of prerequisite conceptual knowledge (Jula'hi & Mohamadin, 2024).

This growing diversity of learners has accelerated the adoption of digital learning in higher education. This aligns with Education 5.1 @ UiTM, which promotes digitally oriented pedagogy to enhance students' learning experiences and graduate competencies. Research has consistently shown that digital learning improves students' learning outcomes by providing structured guidance, personalised learning experiences, and immediate feedback (Tamim et al., 2011; Sung et al., 2016). In addition, the integration of digital learning tools, artificial intelligence (AI) applications, and online problem-solving platforms support students' conceptual understanding and problem-solving skills (Awang et al., 2025; Hwang & Tu, 2021).

Among these technologies, Symbolab has emerged as an AI-powered mathematics learning tool that provides step-by-step solutions and conceptual explanations to support students' understanding of mathematical concepts. Despite its increasing use, limited research has examined students' perceptions of Symbolab and their associations with motivation and mathematics performance, particularly among diploma students. This study addresses this gap by examining students' perceptions of Symbolab and their associations with motivation and performance in the Pre-Calculus (MAT133) course, providing evidence to support the integration of AI-assisted digital learning tools in mathematics education. Specifically, this study aims to answer the following questions:

- RQ1:** What are students' perceptions of Symbolab in terms of user experience, perceived usefulness, and motivation in mathematics learning?
- RQ2:** What are the relationships between user experience, perceived usefulness, and students' motivation when using Symbolab?
- RQ3:** Are there significant differences in students' perceptions of Symbolab between students with and without SPM Additional Mathematics?
- RQ4:** What are the associations between students' perceptions of Symbolab and their mathematics performance?

1.2 Proposed conceptual framework

This study proposed that students' experience with Symbolab is directly associated with their perceived usefulness of the tool and their motivation to learn mathematics, while perceived usefulness is also associated with students' motivation. In turn, motivation is expected to contribute to students' performance in mathematics. Figure 1 provides a clear depiction of the framework.

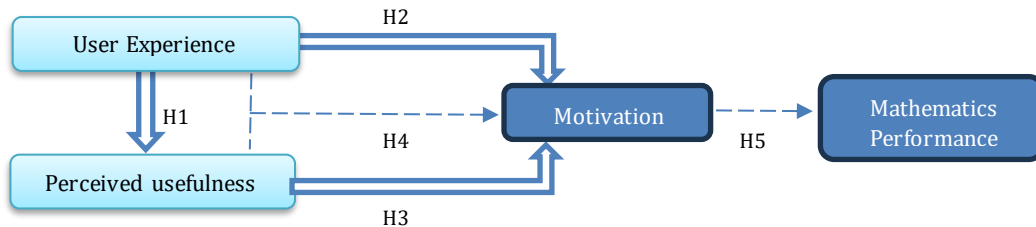


Fig. 1. The proposed conceptual framework

Based on the proposed conceptual framework, the following hypotheses are formulated:

- H1:** User experience is significantly related to perceived usefulness.
- H2:** User experience is significantly related to students' motivation.
- H3:** Perceived usefulness is significantly related to students' motivation.
- H4:** User experience and perceived usefulness significantly predict students' motivation.
- H5:** Students' motivation significantly predicts mathematics performance while controlling for user experience and perceived usefulness.

These hypotheses are supported by previous studies: H1 is supported by Barz et al. (2024), who found that technology-related factors were associated with students' perceived usefulness of e-learning, while Almusharraf (2024) highlighted usability, interactivity, and relevant content as important aspects of students' experiences with learning management systems. H2 is supported by Magtubo et al. (2022), who found that the online learning environment was significantly related to students' intrinsic motivation and engagement. H3 is supported by Huang et al. (2025), who found that perceived usefulness of ICT significantly predicted students' learning motivation. H4 is supported by the combined evidence that technology-related experiences and perceived usefulness are associated with students' motivational responses (Barz et al., 2024; Huang et al., 2025). Finally, H5 is supported by Wang et al. (2022) and Yarn et al. (2022), who reported significant associations between motivation and mathematics performance among undergraduate mathematics students. Sung et al. (2016) and Akpan et al. (2023) provided further evidence that technology-supported learning can be associated with improved learning performance.

1.3 Proposed contribution

This study provides empirical support for the indirect influence of user experience and perceived usefulness on academic achievement through increased student motivation. The study helps to better understand how digital learning tools work in the context of mathematics education. The findings offer educators practical advice on the pedagogical integration of AI-powered mathematics solvers. This study supports Sustainable Development Goal 4 (Quality Education) by recommending reformulated educational policies that improve access to postsecondary mathematics for students from non-science backgrounds.

Furthermore, it is in line with the UiTM Strategic Plan and the Education 5.1 programme, demonstrating how digital-centric pedagogy can create inclusive, lifelong, and technology-enhanced learning environments for a wide range of learners.

2. LITERATURE REVIEW

2.1 Digital technologies for mathematics learning

Digital technologies have been increasing their importance in mathematics education. Rather than functioning as computational aids, these technologies support conceptual understanding, problem-solving and independent learning through dynamic representations, immediate feedback, and aaptive learning pathways.

Empirical evidence confirms that technology integration is associated with improved student achievement and engagement in learning (Tamim et al., 2011; Sung et al., 2016). In the Malaysian context, the Academy of Sciences Malaysia (2023) highlights the importance of developing digital literacy and AI competencies among future graduates to support knowledge-based and innovation-driven development. This underscores the growing necessity of integrating digital technologies into mathematics education to enhance both learning effectiveness and learner readiness for a technology-driven society.

The development of AI has further enhanced digital learning by providing personalised support, adaptive feedback, and improved learning experiences (Hwang & Tu, 2021; Zhang & Aslan, 2021). Awang et al. (2025) confirm that AI-based tools improve students' understanding, engagement, and performance in mathematics. However, the effectiveness of these tools depends not only on their features but also on students' perceptions of usefulness and ease of use. According to the Technology Acceptance Model (TAM) (Davis, 1989), students are more likely to accept and use technology when they perceive it as useful and easy to use (Almusharraf, 2024; Barz et al., 2024; Jiang et al., 2025). This provides the basis for examining students' perceptions and learning outcomes when using AI-based tools such as Symbolab.

2.2 Symbolab as an AI-powered mathematics learning tool

Symbolab is an AI-powered mathematical software that provides step-by-step solutions across topics such as algebra, calculus, and trigonometry. Unlike traditional calculators that only produce final answers, Symbolab functions as a computer-assisted learning tool that helps students understand mathematical concepts through guided solution steps (Paulin & Ndagijimana, 2024; Ndagijimana et al., 2024). Previous studies have also shown that students using Symbolab tend to perform better compared to those using conventional methods, particularly in algebra and trigonometry-related topics (Akpan et al., 2023).

In addition, Symbolab supports independent learning by allowing students to check their work and learn at their own pace outside the classroom. This is especially useful in higher education, where students are expected to take responsibility for their own learning. This aligns with self-regulated learning theory, which emphasises learners' ability to plan, monitor, and evaluate their own learning process (Zimmernan, 2002). Research by Luzano et al. (2024) shows that the use of tools with detailed step-by-step instructions and intuitive user interfaces can help reduce the stress associated with learning and make it more manageable. Studies also suggest that the use of AI-based digital learning tools can enhance students' academic performance and support learning autonomy in mathematics education (Zhai et al., 2021).

However, its effectiveness depends on responsible use, as over-reliance may reduce students' cognitive engagement in problem-solving.

2.3 User experience, perceived usefulness and students' motivation in mathematics learning

Students' acceptance of digital learning tools is influenced by user experience and perceived usefulness. User experience refers to how easy and satisfying a tool is to use, while perceived usefulness refers to students' belief that the tool improves their learning performance. According to the TAM (Davis, 1989), these factors determine technology adoption, and this is supported by recent educational technology studies (Almusharraf, 2024; Barz et al., 2024).

Perceived usefulness and positive user experience are also linked to students' motivation in learning mathematics. When students believe that a tool improves their understanding and performance, their confidence and willingness to learn increase (Amrullah & Sumayani, 2023; Jaafar et al., 2022). Interactive learning environments further enhance engagement and motivation (Pandita & Kiran, 2023; Magtubo et al., 2022). Bandura (1997) also explains that successful learning experiences strengthen self-efficacy, which increases motivation and persistence.

Students' prior mathematical background may influence their perceptions and use of tools such as Symbolab, as prior knowledge affects confidence and learning strategies. Studies also indicate that positive perceptions of educational technology are associated with better academic performance (Akpan et al., 2023; Ndagijimana et al., 2024). Therefore, user experience and perceived usefulness are important factors in understanding students' motivation and their performance in mathematics.

2.4 Research gap

The literature review indicates that Symbolab can support mathematics learning. However, limited research has examined the associations among user experience, perceived usefulness, motivation, prior mathematics background, and actual performance, specifically in the use of Symbolab. Therefore, this study addresses these gaps by examining perceptions of Symbolab among Diploma in Science students, in terms of user experience, perceived usefulness, and motivation, the correlations among these variables, differences between students with and without SPM Additional Mathematics, and the relationships between these perceptions and mathematics performance. Although the concept of perceived usefulness originates from TAM, this model was not tested as a theoretical model in this study. Instead, perceived usefulness was used as an independent perception construct to examine its relationship with students' motivation and mathematics performance.

3. METHODS

3.1 Research design

This study employed a quantitative research design. The primary objective was to examine the associations between students' experiences with Symbolab, their perceptions of its usefulness, their motivation and performance in mathematics. Data were collected using a structured questionnaire and analysed using descriptive and inferential statistical methods.

3.2 Participants and sampling

The targeted population comprised 120 first-semester students from the October 2025 intake of the Diploma in Science (AS120) programme at UiTM Sarawak. The AS120 programme was purposely selected because the programme admits students with and without an Additional Mathematics background.

This cohort therefore provides a relevant demographic for this study, as it represents students entering tertiary-level calculus with varied prior mathematics preparation, allowing their experiences and perceptions of using Symbolab for mathematics learning to be examined within a diverse population.

Participation was voluntary, and 86 students completed and returned the questionnaire, yielding a response rate of 71.67%. Although the final sample was slightly below the sample size of 92 recommended by Krejcie and Morgan (1970) for a population of 120, it represented a substantial proportion of the targeted cohort.

3.3 Instrument and reliability

A structured questionnaire, adapted from Jaafar et al. (2022), was developed to investigate student perceptions of Symbolab in mathematics learning. The original instrument examined students' experiences with technology-enhanced learning in Malaysian higher education. In this study, relevant items were adapted to focus specifically on the use of Symbolab for mathematics learning. The questionnaire measured three constructs: user experience, perceived usefulness, and motivation. User experience covered aspects such as accessibility, ease of use, solution reliability, and visual design. The perceived usefulness section examined how Symbolab supports understanding, visualisation, and independent learning. Meanwhile, the motivation focused on students' engagement and interest in learning mathematics using Symbolab.

The questionnaire also included open-ended questions to obtain students' views and suggestions regarding their experience with Symbolab. The questionnaire items were measured using a five-point Likert scale ranging from 1=Strongly Disagree to 5=Strongly Agree. Higher scores indicated more positive perceptions of Symbolab. Mean scores were calculated for each construct by averaging the relevant items.

The internal consistency of the scales was assessed using Cronbach's alpha. As shown in Table 1, the alpha coefficients for User Experience (0.914), Perceived Usefulness (0.850), and Motivation (0.914) all exceeded the minimum 0.70 threshold suggested by Nunnally (1978). These results indicate that the scales demonstrated good to high internal consistency and are suitable for further multivariate analysis.

Table 1. Reliability test

Variable	No. of items	Cronbach's Alpha
User experience	6	0.914
Perceived usefulness	4	0.850
Motivation	5	0.914

Acceptable value, $\alpha \geq 0.70$

3.4 Data collection and analysis

Data collection was conducted by distributing a structured questionnaire via Google Form to the sampled students to capture their perceptions of using Symbolab in mathematics learning. These perception data were subsequently paired with students' Assessment 2 scores in the MAT133 course to examine the associations between their perceptions of Symbolab, motivation, and mathematics performance. Assessment 2 evaluates students' proficiency in algebraic operations, logarithmic and exponential equations, and function transformations, with Symbolab used mandatorily throughout the assessment.

The assessment was divided into two parts: Part A focused on synthetic and long division of polynomials and solving complex logarithmic and exponential equations using specified Symbolab command inputs; Part B assessed students' understanding of graph transformations involving absolute value, square root, and quadratic functions, as well as their ability to plot systems of inequalities and identify feasible regions.

This study utilised both descriptive and inferential statistical analyses. Descriptive statistics, including mean and standard deviation, were calculated to summarise students' perceptions and their performance in Assessment 2. Pearson correlation analysis was then employed to examine the correlations between user experience, perceived usefulness, and motivation, as well as their associations with mathematics performance. To address demographic differences, an independent samples t-test was conducted to determine whether students' perceptions of Symbolab differed significantly according to their prior background in SPM Additional Mathematics. Finally, multiple regression analyses were conducted to determine whether user experience and perceived usefulness significantly predicted students' motivation, and whether students' motivation significantly predicted mathematics performance controlling for user experience and perceived usefulness.

4. RESULTS AND DISCUSSION

4.1 Respondents' profiles

Table 2 presents the profiles of 86 respondents. The sample was largely female, comprising 68 students (79.07%), while 18 students (20.93%) were male. Regarding prior background, 48 students (55.81%) had enrolled in SPM Additional Mathematics, while 38 students (44.19%) did not enrol in SPM Additional Mathematics. As the sample was heavily skewed in terms of gender, comparing males and females would be statistically unreliable and not meaningful. Instead, this study examined the differences between students with and without SPM Additional Mathematics. This is because they were more balanced in terms of number, and educational background was directly relevant to mathematics perception and motivation.

Table 2. Profiles of respondents

Profiles	Total
Gender (n=86)	
Female	68 (79.07%)
Male	18 (20.93%)
SPM Additional Mathematics (n=86)	
Enrolled	48 (55.81%)
Not enrolled	38 (44.19%)

4.2 Students' perceptions of Symbolab

Table 3 summarises students' perceptions in terms of user experience, perceived usefulness, and motivation in mathematics learning, addressing RQ1. Students reported positive user experience ($M = 4.23$), perceived usefulness ($M = 4.14$), and motivation ($M = 3.96$). The high mean scores suggest that Symbolab is generally well-received by students and may support effective mathematics learning. Prior studies have shown that Symbolab can improve students' problem-solving abilities and enhance their conceptual understanding of mathematical procedures through step-by-step explanations and interactive problem-solving features (Paulin & Ndagijimana, 2024; Ndagijimana et al., 2024).

Students are more likely to be satisfied and engaged in digital learning platforms that offer intuitive interfaces and clear explanations, which facilitate meaningful interaction with learning materials (Pandita & Kiran, 2023; Asgari et al., 2024; Akpan et al., 2023). In addition, user-friendly system design and interactive elements have been shown to significantly enhance students' learning experiences in digital environments (Almusharraf, 2024).

Digital mathematics tools can positively influence students' learning experiences and perceptions of mathematics by providing convenient and efficient problem-solving support (Anggraini & Sunaryantiningasih, 2019). Moreover, mathematics applications that provide instant feedback and structured guidance function as effective formative learning tools that promote deeper understanding and sustained engagement in mathematics learning (Luzano et al., 2024). Collectively, these findings suggest that when students perceive a digital tool as useful for understanding concepts and solving problems, they tend to develop positive attitudes towards the tool and engage more actively in the learning process.

Table 3. Descriptive statistics for user experience, perceived usefulness, and motivation

Variable	N	Mean	Std. Deviation
User Experience	86	4.23	0.68
Perceived Usefulness	86	4.14	0.66
Motivation	86	3.96	0.64

4.3 Relationship between user experience, perceived usefulness, and motivation

Table 4 presents the Pearson correlation results addressing RQ2, which examined the relationships between students' user experience, perceived usefulness, and motivation when using Symbolab. The assumptions for Pearson correlation, including linearity and the presence of influential outliers, were checked before the analysis. The results showed significant, strong positive correlations between user experience and perceived usefulness ($r = .838, p < .01$), user experience and motivation ($r = .776, p < .01$), as well as perceived usefulness and motivation ($r = .819, p < .01$).

The significant positive correlations between user experience, perceived usefulness, and motivation support H1, H2, and H3, respectively. Overall, students with more positive experiences with Symbolab tended to perceive it as more useful and report higher motivation. Similarly, students who perceived Symbolab as more useful tended to report higher motivation. These findings suggest that students' perceptions of Symbolab are positively associated with their motivation in mathematics learning, although the correlational results do not imply causal relationships.

Table 4. Pearson correlation among variables

Variable	User Experience	Perceived Usefulness	Motivation
User Experience	1	.838**	.776**
Perceived Usefulness	.838**	1	.819**
Motivation	.776**	.819**	1

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

Previous studies have shown that technology-enhanced learning environments can foster students' motivation and engagement (Magtubo et al., 2022; McMahon et al., 2024). Positive user experiences with digital learning technologies have also been associated with usability, engagement, and acceptance (Almusharraf, 2024; Barz et al., 2024). In addition, Huang et al. (2025) found that perceived usefulness of ICT significantly predicted students' learning motivation. Together, these findings suggest that positive user experiences and perceived usefulness may be associated with stronger motivation in technology-supported mathematics learning.

4.4 Differences in perceptions between students with and without SPM Additional Mathematics

An independent samples t-test was conducted to address RQ3, which examined whether students' perceptions of Symbolab differed according to their prior background in SPM Additional Mathematics. The assumptions of independent observations and homogeneity of variance were considered before the analysis. As presented in Table 5, no statistically significant differences were found between students with and without SPM Additional Mathematics across user experience, perceived usefulness, and motivation ($p > 0.05$). The very small Cohen's d values ($d < 0.2$) further confirm that the observed differences between the two groups were trivial.

Overall, the findings indicate that students' perceptions of Symbolab did not differ significantly according to their prior mathematics background. Students with and without prior Additional Mathematics reported similar levels of user experience, perceived usefulness, and motivation when using Symbolab.

Table 5. Independent t-Test

Variable	Add Math	N	Mean	SD	t	p-value	Cohen's d	Interpretation
User Experience	Yes	48	4.2188	0.8042	0.182	0.856	0.040	Not Significant
	No	38	4.2456	0.5619				
Perceived Usefulness	Yes	48	4.1250	0.5528	0.290	0.772	0.063	Not Significant
	No	38	4.1667	0.7779				
Motivation	Yes	48	3.9542	0.5660	0.027	0.979	0.006	Not Significant
	No	38	3.9579	0.7295				

The findings also suggest that well-designed digital tools such as Symbolab provide structured support and offer inclusive learning opportunities for students to receive similar experiences, regardless of their mathematics background. Supported by recent studies, the use of Symbolab can improve students' ability to solve mathematical problems and enhance their conceptual understanding through step-by-step solutions and interactive support (Paulin & Ndagijimana, 2024; Ndagijimana et al., 2024).

4.5 Students' academic performance using Symbolab

Figure 2 summarises the descriptive statistics of students' performance in MAT133 Assessment 2. The use of Symbolab was mandatory for answering all questions in the assessment. Students achieved high scores ($M = 92.47$, $SD = 6.63$), with 75% scoring at least 88. The negatively skewed distribution (skewness = -1.040) indicates that scores were concentrated towards the upper end. This pattern indicates that students generally performed well on the assessment. The relatively high performance may be related to their use of Symbolab, particularly its step-by-step solutions and structured problem-solving features. However, as no pre-test was conducted, the learning improvement cannot be conclusively determined.

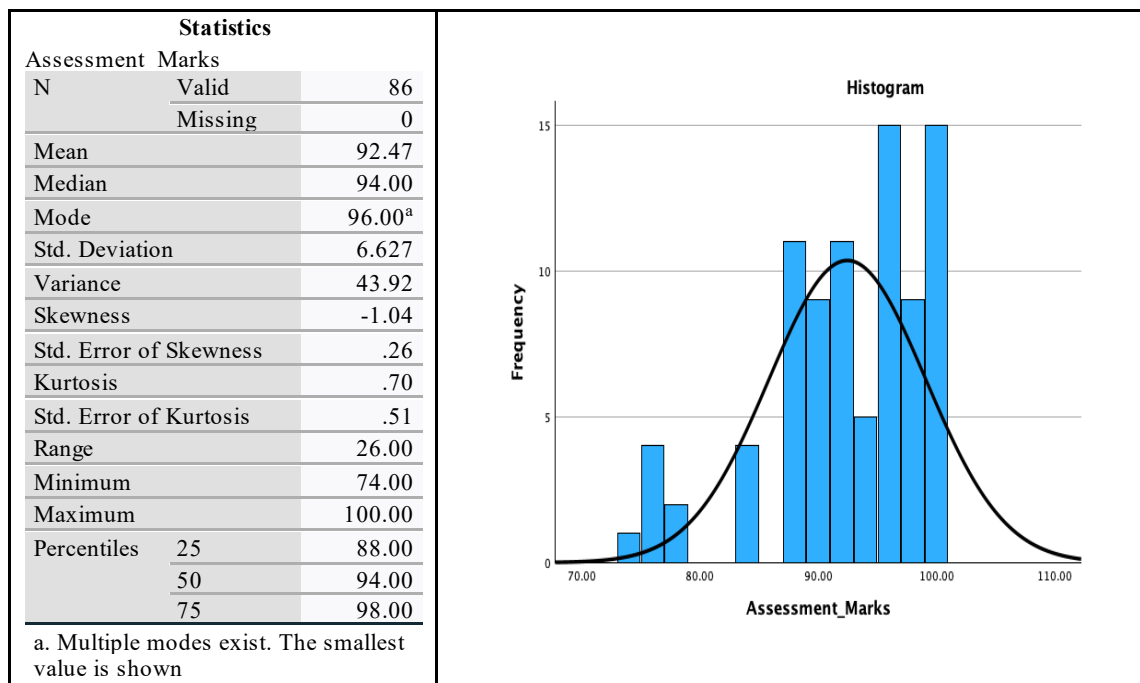


Fig. 2. Descriptive analysis of Assessment 2

4.6 Multiple regression analyses

Multiple regression analyses were conducted to test H4 and H5 and to address RQ4, which examined the associations between students' perceptions of Symbolab and their mathematics performance.

4.6.1 Predictor of motivation in learning mathematics

The first regression was conducted to evaluate H4 by examining whether user experience and perceived usefulness predicted students' motivation. As shown in Table 6, the regression model was significant and explained 69.7% of the variance in motivation ($R^2 = .697$; a adjusted $R^2 = .690$). The Durbin-Watson statistic (1.623) indicates no severe autocorrelation in the residuals, which supports the validity of the regression assumptions (Field, 2018).

Table 6. Multiple regression model on motivation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.835 ^a	.697	.690	.35596	1.623

a. Predictors: (Constant), Perceived Usefulness, User Experience

b. Dependent Variable: Motivation

As stated in Table 7, both predictors had VIF values of 3.359, suggesting that multicollinearity was not severe. Both user experience (standardised $\beta = .300, p = .008$) and perceived usefulness (standardised $\beta = .567, p < .001$) were significant positive predictors of motivation, with perceived usefulness being the stronger predictor based on its larger standardised β . Therefore, H4 was supported.

Table 7. Multiple regression coefficients for motivation

Predictor	B	Std. Error	Beta	t	Sig.	VIF
Constant	0.469	0.256	–	1.833	0.070	–
User Experience	0.284	0.105	0.300	2.713	0.008	3.359
Perceived Usefulness	0.551	0.108	0.567	5.125	<0.001	3.359

a. Dependent Variable: Motivation

Remark: VIF values were below 5, indicating that multicollinearity was not severe based on the adopted threshold.

The findings are consistent with TAM (Davis, 1989), which identifies perceived usefulness as an important factor in technology acceptance. They also align with Bandura's Social Cognitive Theory (Bandura, 1997), which highlights the role of motivational factors in learning behaviour. These findings are further supported by recent studies showing that perceived usefulness and positive experiences with digital learning technologies are associated with student engagement, behavioural intention, and motivation (Barz et al., 2024; Huang et al., 2025; Amrullah & Sumayani, 2023; Jiang et al., 2025). In the context of Symbolab, perceiving the platform as useful and having positive user experiences may therefore be associated with stronger motivation to engage in mathematics learning.

4.6.2 Predictor of mathematics performance

The second regression analysis was conducted to evaluate H5, by examining whether motivation predicted mathematics performance, particularly in MAT133 Assessment 2, while controlling for user experience and perceived usefulness. As shown in Table 8, the overall regression model was statistically significant, $F(3, 82) = 3.766, p = .014$, and explained 12.1% of the variance in Assessment 2 performance ($R^2 = .121$; adjusted $R^2 = .089$). The Durbin–Watson statistic was 2.272, indicating no serious concern regarding independence of residuals.

Table 8. Multiple regression model on Assessment 2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.348 ^a	.121	.089	3.163	3.766	3	82	.014	2.272

a. Predictors: (Constant), Motivation, User Experience, Perceived Usefulness

b. Dependent Variable: Assessment 2

As presented in Table 9, VIF values ranged from 3.304 to 4.422, indicating that multicollinearity was not severe. Motivation was the only significant predictor of Assessment 2 performance ($\beta = .550, p = .004$).

This indicates that students who reported higher motivation when using Symbolab tended to achieve higher Assessment 2 scores. In contrast, user experience ($\beta = .084, p = .671$) and perceived usefulness ($\beta = -.416, p = .059$) were not significant predictors. Thus, H5 was supported.

Table 9. Multiple regression coefficients for Assessment 2

Predictor	B	Std. Error	Beta	t	Sig.	VIF
Constant	41.889	2.319		18.064	<.001	–
User Experience	.414	.971	.084	.427	.671	3.657
Perceived Usefulness	-2.096	1.097	-.416	-1.911	.059	4.422
Motivation	2.850	.975	.550	2.922	.004	3.304

a. Dependent Variable: Assessment 2

Remark: VIF values were below 5, indicating that multicollinearity was not severe based on the adopted threshold.

The significant predictive effect of motivation on mathematics performance indicates that students' motivational levels were an important factor associated with their achievement in the present study. The findings are consistent with previous research on undergraduate mathematics students (Wang et al., 2022; Yarin et al., 2022) and align with evidence that technology-supported learning may contribute to improved learning performance (Sung et al., 2016; Akpan et al., 2023).

4.7 Validated Conceptual Framework

By integrating the multiple regression results, an indirect pathway was observed, where user experience and perceived usefulness influence students' Assessment 2 performance through motivation. The relation highlights that user experience and perceived usefulness significantly influence students' motivations, which subsequently contribute to their mathematics performance. The findings support the proposed conceptual framework in Figure 1, which highlights that perceived usefulness emerged as the strongest predictor of motivation. Therefore, the proposed conceptual framework was retained without modification.

5. CONCLUSION AND RECOMMENDATION

This study examined students' perceptions of Symbolab in terms of user experience, perceived usefulness, and motivation, as well as associations among these constructs and mathematics performance. Overall, students reported positive perceptions of Symbolab, showing that the software was generally well-received by students. Correlation analysis showed significant positive associations among user experience, perceived usefulness, and motivation. Multiple regression analyses further indicated that both user experience and perceived usefulness were significant predictors of students' motivation, with perceived usefulness emerging as the stronger predictor. In addition, motivation was significantly associated with mathematics performance, with higher motivation corresponding to higher Assessment 2 scores. No significant differences were found between students with and without an SPM Additional Mathematics background, suggesting that Symbolab can support students with diverse levels of prior mathematical knowledge. The findings also indicate that motivated students tend to achieve better mathematics performance, highlighting the importance of fostering positive learning experiences through AI-powered learning tools.

Therefore, educators may consider integrating AI-based tools such as Symbolab as complementary resources for problem solving, independent learning, and feedback, while ensuring that their use is guided by sound mathematical understanding. This supports UiTM's Education 5.1 agenda and SDG4 (Quality Education), which emphasise technology-enhanced education. Institutions should also provide guidance on the appropriate and ethical use of AI to ensure students use it as learning aids rather than simply as answer-generating tools. Future research could adopt quasi-experimental or longitudinal designs to examine the long-term impact of Symbolab or other AI-powered learning tools on students' learning outcomes and explore other factors, such as self-efficacy and digital literacy, that may influence students' motivation and mathematics performance.

6. ACKNOWLEDGMENT/ FUNDING

The authors thank the reviewers and editors for their useful insights to improve this paper and the respondents who took part in the survey. The study was conducted independently with no external funding involved.

7. CONFLICT OF INTEREST STATEMENT

The authors declared no conflict of interest related to the conduct, authorship, and publication of this study.

8. AUTHORS' CONTRIBUTIONS

The authors contributed equally to all parts of this work.

9. DECLARATION OF GENERATIVE AI IN THE WRITING PROCESS

During the preparation of this paper, the authors used ChatGPT and Grammarly to assist with language editing, through paraphrasing and sentence restructuring. The authors carefully reviewed and revised AI-generated content and take full responsibility for the accuracy, clarity, and originality of this publication.

10. DATA AVAILABILITY/ SUPPLEMENTARY MATERIALS

The corresponding author can provide the datasets used in the current study upon reasonable request.

11. ETHICS STATEMENT

This manuscript complied with all ethical compliances.

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