Acceptance of Generative Artificial Intelligence (GenAI) for Learning Additional Mathematics among Malaysian Secondary Students: A Technology Acceptance Model Approach

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ABSTRACT

Generative Artificial Intelligence (GenAI) has increasingly become a learning support tool among secondary-school students, including those studying Additional Mathematics. This study examined the factors influencing Malaysian secondary school students' behavioural intention to use GenAI for learning Additional Mathematics based on the Technology Acceptance Model (TAM). The study employed a quantitative approach using an online questionnaire administered to 131 secondary students taking Additional Mathematics. The data were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM). The measurement model demonstrated satisfactory reliability and validity, while the structural model showed acceptable predictive performance. The findings indicated that perceived ease of use significantly influenced perceived usefulness, while perceived usefulness significantly affected both attitude and behavioural intention. Attitude also had a significant positive effect on behavioural intention. However, perceived ease of use did not significantly influence attitude. Overall, four of the five proposed relationships were supported, indicating that TAM provides a useful framework for explaining GenAI acceptance among Malaysian secondary students learning Additional Mathematics. The findings further suggest that students' intention to use GenAI is influenced more strongly by its perceived usefulness and their attitude towards the technology than by ease of use alone. The study provides insights into the factors that may support the effective integration of GenAI into Additional Mathematics learning, particularly among students preparing for the SPM examination.

Keywords: Generative Artificial Intelligence, Technology Acceptance Model, Additional Mathematics, behavioural intention, secondary students, Malaysia, PLS-SEM

INTRODUCTION

Generative artificial intelligence (GenAI) has become increasingly relevant to education because of its ability to generate new content in response to user prompts. Unlike conventional digital learning tools that mainly provide predetermined information or functions, GenAI can produce text, explanations, examples and other forms of content interactively. UNESCO highlighted the rapid emergence of publicly available GenAI tools and their potential applications in teaching and learning, while also emphasising concerns related to ethics, data privacy, age-appropriate use and responsible adoption (Miao & Holmes, 2023).

The Malaysian government has also begun to provide institutional support for AI literacy in schools. The Ministry of Education Malaysia (KPM) issued Surat Pekeliling Ikhtisas KPM Bil. 2 Tahun 2026: Panduan Literasi Kecerdasan Buatan (AI) Kementerian Pendidikan, which provides guidance for AI literacy within KPM educational institutions (Jamin et al., 2026). The guideline aims to develop students who are digitally and AI literate, capable of critical and creative thinking, and able to use AI responsibly. It covers four main areas: AI governance, teaching and learning, lifelong learning and AI ethics. The guideline also promotes practices such as understanding AI, critically evaluating AI outputs, using AI tools, creating with AI and applying AI to problem-solving. This development demonstrates that AI literacy has become part of Malaysia's current educational agenda rather than being solely an individual or informal student practice.

However, several gaps remain in the existing literature. First, research on GenAI adoption has frequently focused on university students (Al Giffari et al., 2023; Foroughi et al., 2025; Yap et al., 2025), while studies involving secondary-school students remain comparatively limited. Second, Malaysian studies have mainly examined GenAI in areas such as English writing and general learning rather than mathematics (Aineh & Ngui, 2024; Jen & Salam, 2025). Third, although recent international research has examined GenAI acceptance in upper-secondary mathematics, such evidence comes from educational contexts outside Malaysia. There is therefore limited evidence on why Malaysian secondary-school students intend to use GenAI specifically for mathematics learning.

This gap is particularly relevant secondary school students, who are preparing for the Sijil Pelajaran Malaysia (SPM) examination and may use digital technologies as part of their learning process. Additional Mathematics involves complex concepts and problem-solving tasks that may lead students to seek additional explanations, examples and learning support. However, whether students intend to use GenAI for this purpose depends not only on its availability but also on how they perceive and evaluate the technology. Therefore, this study examines the behavioural intention of Malaysian secondary students to use GenAI for learning Additional Mathematics, using the Technology Acceptance Model (TAM) to examine the relationships between perceived ease of use, perceived usefulness, attitude and behavioural intention.

LITERATURE REVIEW

Technology Acceptance Model

The Technology Acceptance Model (TAM), developed by Davis (1989), is one of the established theoretical models used to explain individuals' acceptance of information technology. The model proposes that perceived usefulness and perceived ease of use are important determinants of technology acceptance. Perceived usefulness refers to the extent to which an individual believes that using a particular technology will improve performance, while perceived ease of use refers to the extent to which an individual believes that using the technology will require little effort. Both both constructs were important in explaining technology acceptance, with perceived usefulness showing a particularly strong relationship with intended use. The model also proposes that perceived ease of use can contribute to perceived usefulness because a technology that requires less effort may be more readily recognised as beneficial. The relationship between these perceptions, attitude and intention was further examined by Davis et al. (1989). Their findings provided support for the importance of perceived usefulness in explaining behavioural intention and demonstrated the relevance of attitudes in technology acceptance. Consequently, TAM has been adapted to examine the acceptance of different educational technologies and remains relevant as new forms of technology emerge.

The development of generative artificial intelligence (GenAI) provides a contemporary context in which TAM can be applied. Unlike many conventional educational technologies, GenAI tools allow users to interact with systems through natural-language prompts and receive dynamically generated responses. Students may therefore evaluate GenAI according to whether it is easy to interact with and whether it provides meaningful benefits for their learning.

Generative AI in Education

The emergence of GenAI has expanded the range of digital tools available for educational purposes. Applications such as ChatGPT can generate explanations, examples, summaries, feedback and responses based on users' prompts. This interactive characteristic allows students to seek assistance according to their immediate learning needs rather than relying solely on fixed learning materials. As a result, GenAI has attracted increasing attention as a potential learning support tool.

Research examining students' acceptance of ChatGPT indicates that perceived usefulness and ease of use remain relevant to educational GenAI adoption, although their effects may differ across contexts. Tiwari et al. (2024), for example, examined factors influencing students' adoption and use of ChatGPT for educational purposes using a TAM-based framework. Their findings showed that perceived usefulness contributed to students' attitudes towards ChatGPT, while the influence of perceived ease of use was less consistent.

More recent research has continued to apply TAM to students' behavioural intention to use ChatGPT. A 2025 study examining students' intention to use ChatGPT for educational purposes found that perceived usefulness and perceived ease of use contributed to attitudes towards continued use, while attitude positively influenced intention to continue using ChatGPT (Sun et al., 2025). These findings suggest that students' acceptance of GenAI may involve both their assessment of the technology's practical value and their overall evaluation of using it.

However, the educational value of GenAI should not be interpreted as evidence that students will automatically adopt the technology. Students may recognise that GenAI can provide useful assistance while still differing in their willingness to use it. Factors such as ease of interaction, perceived benefits, confidence in the technology and students' attitudes may therefore influence their intention to incorporate GenAI into learning activities. This makes technology acceptance particularly relevant when examining GenAI use among students.

GenAI in Secondary Education and Mathematics Learning

Although much early GenAI research in education focused on university students, attention has increasingly shifted towards secondary education. This is particularly important because secondary-school students may encounter GenAI differently from university students. Their use of GenAI is more closely connected to school curricula, teacher guidance, examination requirements and age-related differences in digital experience. Recent research has begun to examine GenAI specifically in upper-secondary mathematics education. Setälä et al. (2025) investigated Finnish upper-secondary students' perceptions of using GenAI in mathematics education through the lens of technology acceptance. The study examined constructs including perceived usefulness, perceived ease of use, perceived enjoyment and intention to use GenAI. This study is particularly relevant to the present research because it directly connects upper-secondary students, GenAI, mathematics learning and technology acceptance.

The relevance of TAM to GenAI-supported mathematics learning is also supported by more recent research involving secondary students. Xie et al. (2026) examined Chinese secondary-school students' adoption of AI-based intelligent technology in mathematics learning using an extended TAM. The findings showed that perceived usefulness significantly predicted behavioural intention, while perceived ease of use also had a significant effect. Behavioural intention was subsequently associated with actual use. Moreover, a study involving pre-service mathematics teachers found significant effects of perceived ease of use on perceived usefulness and perceived usefulness on attitude towards using ChatGPT (Demir, 2026). Attitude also significantly influenced actual use. Although the participants were prospective teachers rather than secondary students, the findings provide recent evidence that the central relationships proposed by TAM remain relevant when the technology being examined is ChatGPT and the subject context is mathematics. Futrthermore, Valle et al. (2026) examined the adoption of GenAI for mathematics learning among secondary and tertiary students using UTAUT. The study found that social influence, habit, facilitating conditions, and knowledge of AI significantly predicted behavioural intention to use GenAI.

GenAI in the Malaysian Secondary-School Context

The Malaysian secondary-school context provides an important setting for examining GenAI adoption. Recent studies show that GenAI is already being used and discussed in Malaysian secondary education. Aineh and Ngui (2024) examined Malaysian secondary-school students' and teachers' perceptions of using ChatGPT to improve English writing and found that the use of ChatGPT are influenced by technology, digital literacy, its perceived usefulness for tasks such as proofreading and idea generation, and concerns about overdependence. Mohamad Zabhi and Hassan (2025) also reported positive perceptions of ChatGPT as a pedagogical support tool and indicated that it could assist their understanding of instructional content. However, the study identified concerns regarding overreliance, factchecking and the need for teacher guidance. Similarly, Ling and Salam (2025) examined GenAI use in Malaysian secondary-school essay writing and highlighted its potential to support

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students' learning. The findings highlighted the potential of GenAI tools such as ChatGPT, Gemini and Copilot to provide personalised feedback and ideas and developed a learning aid to guide secondary students in using Gemini. Importantly, the authors noted that research concerning GenAI use among Malaysian secondary-school students remains limited. Man et al. (2025) further examined Malaysian secondary students' perceptions of ethical issues related to GenAI in learning, and the result proves that GenAI has become sufficiently relevant within Malaysian secondary education for questions concerning responsible and ethical use to emerge among students.

LITERATURE REVIEW

Perceived Ease of Use and Perceived Usefulness

Perceived ease of use refers to an individual's perception that a technology can be used easily without requiring substantial effort (Davis, 1989). In this study, perceived ease of use refers to the extent to which Malaysian secondary-school students perceive GenAI as easy to learn, understand, and use when studying additional mathematics. Demir (2026) found that perceived ease of use significantly predicted perceived usefulness among pre-service mathematics teachers using ChatGPT. Although the participants differed from those in the present study, the finding suggests that ease of interaction with GenAI may influence how useful students perceive the technology to be. For secondary students, GenAI that is straightforward to access and interact with may be more likely to be viewed as useful for learning Additional Mathematics. Therefore, the following hypothesis is proposed:

H1: Perceived ease of use has a significant positive effect on perceived usefulness of GenAI for learning Additional Mathematics among Malaysian secondary students.

Perceived Ease of Use and Attitude

Perceived ease of use may also influence how students evaluate their experience with GenAI. When students perceive a technology as simple to learn and operate, they may experience fewer difficulties when interacting with it and may consequently develop a more favourable attitude towards its use. Evidence from ChatGPT use in mathematics also provides support for the relevance of ease of use. Demir (2026) ound a significant effect of perceived ease of use on perceived usefulness and reported relationships among the TAM constructs in the context of ChatGPT use among pre-service mathematics teachers. In the context of Additional Mathematics, students may interact with GenAI to obtain explanations, ask follow-up questions, clarify mathematical concepts, and explore different solution approaches. If these interactions can be carried out without considerable effort, students may be more comfortable with the technology and evaluate its use more positively. Based on this reasoning, the following hypothesis is proposed:

H2: Perceived ease of use has a significant positive effect on students' attitudes towards using GenAI for learning Additional Mathematics.

Perceived Usefulness and Attitude

Perceived usefulness refers to an individual's belief that using a particular technology can improve their performance and enable them to complete tasks more effectively (Davis, 1989). In the context of this study, perceived usefulness refers to the extent to which Malaysian secondary-school students believe that using GenAI can improve their learning and performance in additional mathematics. Demir (2026) found that perceived usefulness significantly predicted attitude towards ChatGPT use among pre-service mathematics teachers Similarly, the upper-secondary mathematics study by Setälä et al. (2025) found that perceived usefulness had a strong influence on intention to use GenAI. For secondary students, GenAI may be perceived as useful when it helps them understand difficult concepts, obtain explanations, practice questions or check their work. Such perceptions may contribute to a more favourable attitude towards using GenAI for Additional Mathematics. Hence:

H3: Perceived usefulness has a significant positive effect on students' attitudes towards using GenAI for learning Additional Mathematics.

Perceived Usefulness and Behavioural Intention

Perceived usefulness is expected to play an important role in shaping students' intention to use GenAI because students are more likely to adopt a technology when they believe that it can provide meaningful benefits for their learning. In the context of Additional Mathematics, students may perceive GenAI as useful when it helps them understand difficult concepts, obtain step-by-step explanations, practise mathematical questions, check their solutions, or explore alternative methods of solving problems. These perceived benefits may encourage students to consider GenAI as a valuable learning resource and increase their willingness to use it during their studies. Setälä et al. (2025) reported a strong influence of perceived usefulness on upper-secondary students' intention to use GenAI in mathematics education. Xie et al. (2026) similarly found that perceived usefulness predicted behavioural intention among secondary students using AI-based technology in mathematics learning. Although the study examined AI-based technology rather than specifically GenAI, the findings provide supporting evidence for the relevance of perceived usefulness in mathematics-related technology acceptance. Thus:

H4: Perceived usefulness has a significant positive effect on students' behavioural intention to use GenAI for learning Additional Mathematics.

Attitude and Behavioural Intention

Attitude represents an individual's overall favourable or unfavourable evaluation of using a technology (Davis et al., 1989). In the context of GenAI, students' attitudes may reflect whether they view the technology as beneficial, acceptable, and appropriate for supporting their learning. A positive attitude may develop when students perceive GenAI as a useful and suitable tool for completing learning activities, understanding difficult topics, and supporting their academic needs. When students have a favourable evaluation of GenAI, they may be more willing to consider using it as part of their regular learning activities. More recent evidence from GenAI research also supports the relationship between attitude and behavioural intention. Sun et al. (2025) found that students' attitudes towards continued use of ChatGPT positively influenced their intention to continue using the technology. Therefore, students who hold a favourable attitude towards GenAI may be more likely to intend to use it for Additional Mathematics learning. Therefore:

H5: Students' attitudes towards using GenAI have a significant positive effect on their behavioural intention to use GenAI for learning Additional Mathematics.

METHODOLOGY

Sampling

The participants in this study were secondary-school students who were expected to sit for Additional Mathematics in the SPM examination. Participants were recruited through convenience sampling, whereby students who were accessible to the researchers were selected for participation. Hair et al. (2003), explained that convenience sampling involves obtaining participants based on their availability. This sampling approach was appropriate for the study as the researchers could readily reach students within the intended population, thereby facilitating data collection within the available time and resources

The sample size requirement was established before data collection using G*Power 3.1 and an a priori power analysis (Faul et al., 2009). The calculation followed Cohen's (1988) recommendation of a medium effect size of 0.15 (f^2), together with a 0.05 significance level and 0.80 statistical power. The calculation was based on the endogenous construct with the greatest number of predictors in the proposed model and produced a minimum requirement of 107 respondents. In the actual data collection, 131 usable responses were obtained, representing a sample larger than the calculated minimum. A post hoc analysis subsequently produced an estimated statistical power of approximately 0.98. Hence, the 131 valid responses provided an adequate sample for the statistical analysis conducted in this study.

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Data Collection

To examine the proposed conceptual framework, data were collected through an online questionnaire distributed using Google Forms. The questionnaire was designed to gather responses from the target participants in a convenient and accessible manner. All measurement items were assessed using a five-point Likert scale, where 1 represented "strongly disagree" and 5 represented "strongly agree." The instrument covered four main constructs relevant to the proposed model, namely Perceived Ease of Use, Perceived Usefulness, Attitude, and Behavioural Intention. Overall, the questionnaire contained 21 measurement items, with the items distributed across the four constructs to assess students' perceptions, attitudes, and intention to use GenAI for learning Additional Mathematics.

Measures and Instrument

A questionnaire consisting of 20 items was developed for data collection in this study. It was divided into two main sections. The first section gathered the respondents' demographic and GenAI-related information, including gender, previous use of GenAI for learning Additional Mathematics, and the type of GenAI tool commonly used for Additional Mathematics. The second section focused on the constructs in the proposed conceptual framework, which examined secondary-school students' behavioural intention to use Generative Artificial Intelligence (GenAI) for studying Additional Mathematics. The constructs measured were Perceived Ease of Use, Perceived Usefulness, Attitude, and Behavioural Intention. Table 1 presents the constructs and their respective measurement items. The items were adopted and adapted from established instruments in previous studies and modified where appropriate to reflect the context of GenAI use among secondary-school students studying Additional Mathematics.

Table 1: Overview of the Constructs

Construct	Item	Source
Perceived Ease of Use, PEOU	4	(Yuli Bangun et al., 2025)
Perceived Usefulness, PU	5	(Ni & Cheung, 2023)
Attitude toward use, ATT	3	(2023)
Behavioural Intention, BI	4	(Yuli Bangun et al., 2025)

Respondants' Profile

Table 2 presents the demographic and GenAI usage profile of the 131 students included in the final dataset. In terms of gender, 97 students (74.0%) were female, while 34 students (26.0%) were male, indicating that female students constituted the larger proportion of the sample. Regarding previous use of GenAI for Additional Mathematics, 125 students (95.4%) reported having used GenAI, while only 6 students (4.6%) indicated that they had not used GenAI for studying Additional Mathematics. This indicates that almost all students in the study had prior experience using GenAI in the context of Additional Mathematics. In terms of the frequency of GenAI use, 54 students (41.2%) reported using GenAI sometimes, representing the largest proportion of the sample. This was followed by 42 students (32.1%) who reported using GenAI often, while 21 students (16.0%) reported using GenAI rarely. Meanwhile, 8 students (6.1%) indicated that they always used GenAI, and 6 students (4.6%) reported that they never used GenAI for studying Additional Mathematics. Overall, the findings indicate that the majority of students had prior experience using GenAI for Additional Mathematics, with most students reporting that they used GenAI sometimes or often. This suggests that GenAI was already relatively familiar to the students and had been incorporated into the learning practices of a substantial proportion of the sample.

Table 2: Demographic Information

Characteristics	Category	Frequency (n)	Percentage (%)
Gender	Female	97	74.0
	Male	34	26.0
	Yes	125	95.4

Previous AI use for Additional Mathematics	No	6	4.6
Frequency of GenAI use	Never	6	4.6
	Rarely	21	16.0
	Sometimes	54	41.2
	Often	42	32.1
	Always	8	6.1

The results in Table 3 indicate that ChatGPT was the most commonly used AI tool among the respondents, with 66 students reporting its use for studying Additional Mathematics. This was followed by Gemini, which was reported by 31 students. A further 20 students indicated that they used both ChatGPT and Gemini, showing that some students used more than one GenAI platform for their learning. A smaller number of respondents reported using other AI tools or combinations of tools. Dola AI was reported by three students, while two students indicated using ChatGPT together with Dola AI. Other combinations included ChatGPT with Meta AI, ChatGPT with Gemini and GauthMath, ChatGPT with Gauth, and Gemini with Gauth. In addition, individual respondents reported using Claude, TurboLearn, and AI Mode. Two respondents selected "Others" without specifying the particular tool. Overall, the results show that ChatGPT and Gemini were the main AI tools used by the students for Additional Mathematics, while a smaller group explored multiple AI tools or other digital platforms. This suggests that the students were not restricted to a single AI platform and that some had experience using different tools to support their Additional Mathematics learning.

Table 3: Type of GenAI Usually Used for Additional Mathematics

Type of GenAI / AI tool used	Frequency (n)
ChatGPT	66
Gemini	31
ChatGPT + Gemini	20
Dola AI	3
ChatGPT + Dola AI	2
ChatGPT + Meta AI	1
ChatGPT + Gemini + GauthMath	1
ChatGPT + Gemini + TikTok + YouTube	1
ChatGPT + Gauth	1
Gemini + Gauth	1
Claude	1
TurboLearn	1
AI Mode	1
Others (not specified)	2

RESULT

The research model was evaluated using SmartPLS 3.0 through the partial least squares structural equation modelling (PLS-SEM) approach (Ringle et al., 2015). The analysis was conducted in two main stages. First, the measurement model was examined to establish the reliability and validity of the constructs. This was followed by an assessment of the structural model to evaluate the proposed relationships and test the hypotheses (Anderson & Gerbing, 1988).

Since the predictor and criterion constructs were measured through the same self-administered questionnaire, the possibility of common method variance (CMV) was considered. Following Podsakoff et al. (2003). Harman's single-factor test was performed to assess this issue. The first unrotated factor explained 48.14% of the total variance, which remained below the commonly applied 50% criterion. Therefore, CMV was not regarded as a substantial issue in the present study.

The distributional characteristics of the data were further examined using Mardia's multivariate skewness and kurtosis, following the recommendations of Hair et al. (2021) and Cain et al. (2017). The results showed significant multivariate skewness ($\beta = 23.9542$, $p < 0.01$) and multivariate kurtosis ($\beta = 187.0607$, $p < 0.01$). Both values exceeded the respective cut-off values of +1 for skewness and +20 for kurtosis, indicating that the

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data did not satisfy the assumption of multivariate normality. Consequently, the use of PLS-SEM was considered appropriate for analysing the data in this study.

Measurement Model

The reflective measurement model was assessed to determine whether the indicators adequately represented their respective constructs in terms of reliability and validity as suggested by Hair et al. (2021). This assessment examined the quality of the measurement items and their ability to consistently measure the intended constructs. Outer loadings, composite reliability (CR), and average variance extracted (AVE) were examined to assess the convergent validity and reliability of the measurement model. The results reported in Table 4 indicate that the outer loading values were between 0.740 and 0.903. According to Hair et al. (2021), values above 0.708 indicate an acceptable level of indicator reliability. Since all retained items exceeded this criterion, the indicators were considered sufficiently reliable in representing their respective constructs At the construct level, the CR values ranged from 0.863 to 0.923, surpassing the recommended value of 0.70. This demonstrates that the measurement items within each construct had satisfactory internal consistency. The AVE values, which assess the amount of variance captured by a construct from its indicators, ranged from 0.616 to 0.776. All four constructs therefore exceeded the minimum AVE criterion of 0.50 recommended by Hair et al. (2021) providing evidence of adequate convergent validity. Taken together, the measurement results demonstrate that PEOU, PU, ATT, and BI met the required standards for reliability and convergent validity. The satisfactory outer loadings, CR, and AVE values indicate that the retained indicators adequately measured their intended constructs. Hence, the reflective measurement model was considered acceptable, allowing the study to proceed with the structural model assessment.

Table 4: Reliability and Convergent Validity

<table>
<tr><th>Construct</th><th>Items</th><th>Outer Loadings</th><th>CR</th><th>AVE</th></tr>
<tr><td rowspan="3">PERCEIVED EASE OF USE (PEOU)</td><td>PEOU1</td><td>0.746</td><td rowspan="3">0.863</td><td rowspan="3">0.678</td></tr>
<tr><td>PEOU2</td><td>0.852</td></tr>
<tr><td>PEOU4</td><td>0.867</td></tr>
<tr><td rowspan="5">PERCEIVED USEFULNESS (PU)</td><td>PU1</td><td>0.808</td><td rowspan="5">0.889</td><td rowspan="5">0.616</td></tr>
<tr><td>PU2</td><td>0.785</td></tr>
<tr><td>PU3</td><td>0.791</td></tr>
<tr><td>PU4</td><td>0.74</td></tr>
<tr><td>PU5</td><td>0.801</td></tr>
<tr><td rowspan="3">ATTITUDE (ATT)</td><td>ATT1</td><td>0.875</td><td rowspan="3">0.912</td><td rowspan="3">0.776</td></tr>
<tr><td>ATT2</td><td>0.903</td></tr>
<tr><td>ATT3</td><td>0.865</td></tr>
<tr><td rowspan="4">BEHAVIOURAL INTENTION (BI)</td><td>BI1</td><td>0.879</td><td rowspan="4">0.923</td><td rowspan="4">0.749</td></tr>
<tr><td>BI2</td><td>0.894</td></tr>
<tr><td>BI3</td><td>0.867</td></tr>
<tr><td>BI4</td><td>0.819</td></tr>
</table>

Discriminant validity was examined to ensure that the constructs measured in the model represent different concepts rather than overlapping with one another. The Heterotrait-Monotrait (HTMT) ratio was used for this assessment following the recommendation of Henseler et al. (2015). A value of less than 0.90 suggests that the constructs can be empirically distinguished. Based on Table 5, all HTMT ratios were below the 0.90 criterion. These findings indicate that the constructs were sufficiently different, thereby establishing discriminant validity for the measurement model.

Table 5: Discriminant Validity

	PEOU	**PU**	**ATT**	**BI**
PEOU				

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PU	0.684			
ATT	0.576	0.781		
BI	0.59	0.807	0.874	

Structural Model

After establishing the adequacy of the measurement model, the structural model was examined to determine the strength and significance of the proposed relationships between the constructs (Hair et al., 2021). The analysis considered the path coefficient (β), standard error, t-value, p-value, confidence interval, and VIF. Hypothesis testing was conducted using the PLS bootstrapping procedure with 5,000 resamples.

The results in Table 6 indicate that four of the five proposed relationships were statistically significant at the 0.05 level. The relationship between PEOU and PU was positive and significant ($\beta = 0.560$, $t = 8.515$, $p < 0.001$), providing support for H1. In contrast, the relationship between PEOU and ATT did not reach the 0.05 significance level ($\beta = 0.144$, $t = 1.955$, $p = 0.051$). Therefore, H2 should not be supported based on the conventional significance criterion of $p < 0.05$. Meanwhile, PU demonstrated a significant positive relationship with ATT ($\beta = 0.582$, $t = 8.044$, $p < 0.001$), supporting H3. Furthermore, PU had a significant positive effect on BI ($\beta = 0.354$, $t = 3.768$, $p < 0.001$), supporting H4. Similarly, ATT significantly predicted BI ($\beta = 0.526$, $t = 6.047$, $p < 0.001$), supporting H5. Compared with PU → BI, the larger coefficient for ATT → BI suggests that students' overall attitude towards GenAI had a stronger association with their intention to use the technology. Overall, the structural model provides support for H1, H3, H4, and H5, whereas H2 was not supported. Among the significant paths, PU → ATT recorded the largest coefficient ($\beta = 0.582$), followed by ATT → BI ($\beta = 0.526$), PEOU → PU ($\beta = 0.560$), and PU → BI ($\beta = 0.354$).

The structural model was also examined for potential multicollinearity among the predictor constructs using the variance inflation factor (VIF). The VIF values reported in Table 6 ranged from 1.000 to 1.802, which are well below the commonly accepted threshold of 5.00 (Hair et al., 2021). This indicates that the predictor variables did not exhibit problematic levels of overlap, and therefore multicollinearity was not considered a concern in the structural model.

Table 6: Path Coefficient and Hypothesis Testing

	Beta	SE	T Values	P Values	LL	UL	VIF	DECISION
PEOU → PU	0.56	0.066	8.515	0	0.414	0.675	1	Supported
PEOU → ATT	0.144	0.072	1.955	0.051	-0.003	0.281	1.462	Not Supported
PU → ATT	0.582	0.073	8.044	0	0.443	0.723	1.462	Supported
PU → BI	0.354	0.094	3.768	0	0.174	0.536	1.802	Supported
ATT → BI	0.526	0.087	6.047	0	0.352	0.694	1.802	Supported
PEOU → PU	0.56	0.066	8.515	0	0.42	0.678	1	Supported

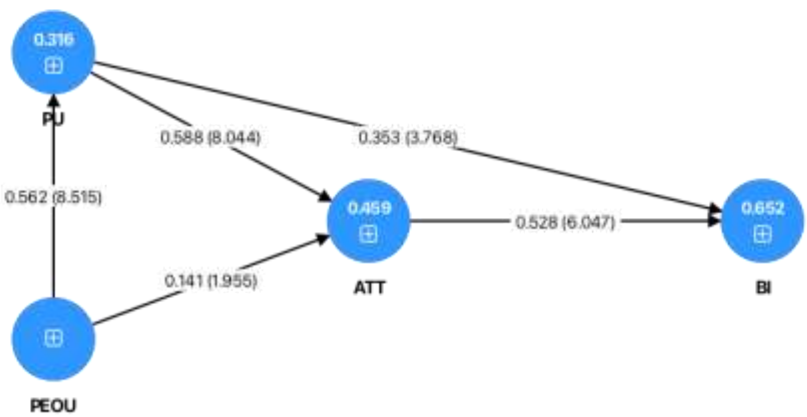

Fig. 1 Structural Model

The structural model was further assessed by examining its explanatory power, effect sizes, and predictive relevance. The coefficient of determination (R^2) was first considered to determine how much variance in each endogenous construct could be explained by its predictors. Based on Chin (1998), R^2 values of 0.67, 0.33, and 0.19 indicate substantial, moderate, and weak levels of predictive accuracy, respectively. As reported in Table 7, the R^2 value for PU was 0.316, indicating a weak level of predictive accuracy. In contrast, ATT recorded an R^2 of 0.459, while BI obtained an R^2 of 0.652, with both values representing moderate predictive accuracy. Among the endogenous constructs, BI had the highest R^2, indicating that the model explained a relatively large proportion of the variance in students' behavioural intention to use GenAI for Additional Mathematics.

The effect size (f^2) was then examined to determine the contribution of individual predictor constructs to their respective endogenous variables. Following Cohen (1988), values of 0.02, 0.15, and 0.35 represent small, medium, and large effects, respectively. The results in Table 7 show that PEOU → PU produced a large effect ($f^2 = 0.462$). Similarly, PU → ATT showed a large effect ($f^2 = 0.436$). The effect of ATT → BI was also large ($f^2 = 0.445$). Meanwhile, PU → BI demonstrated a medium effect ($f^2 = 0.198$). In contrast, PEOU → ATT recorded a small effect ($f^2 = 0.025$). These results indicate that PEOU made a substantial contribution to PU, while PU and ATT were particularly influential in explaining ATT and BI, respectively.

The model's predictive relevance was evaluated using Q^2 values. According to Hair et al. (2021), a Q^2 value greater than zero indicates that the model has predictive relevance for the corresponding endogenous construct. As shown in Table 7, the Q^2 values were 0.296 for PU, 0.203 for ATT, and 0.233 for BI. Since all three values were above zero, the structural model demonstrated predictive relevance for all endogenous constructs.

Table 7: R2 and Effect Size

	R^2	Q^2	f^2		
			PU	ATT	BI
PEOU			0.462	0.025	
PU	0.316	0.296		0.436	0.198
ATT	0.459	0.203			0.445
BI	0.652	0.233			

DISCUSSION

The present study examined students' behavioural intention to use GenAI for learning Additional Mathematics through the Technology Acceptance Model (TAM). TAM provides a suitable framework for this context because it explains technology acceptance through students' perceptions of ease of use and usefulness, their attitude towards the technology, and their subsequent behavioural intention to use it. In the context of Malaysian secondary education, examining these relationships is particularly relevant for secondary students who take Additional Mathematics and are preparing for the Sijil Pelajaran Malaysia (SPM) examination. These students may encounter challenging mathematical concepts and problem-solving tasks that require additional learning support beyond classroom instruction. Therefore, understanding the factors that shape their intention to use GenAI can provide insight into how they are likely to accept and incorporate this emerging technology into their mathematics learning.

The demographic and GenAI usage profile also provides important context for interpreting the results. Most respondents had previous experience using GenAI for Additional Mathematics, with 125 out of 131 students reporting that they had used GenAI for this purpose. The students also reported using a range of GenAI tools, with ChatGPT and Gemini being the most commonly used, while some students reported using combinations of different platforms. This indicates that the respondents were generally familiar with GenAI and had already encountered different forms of the technology in their Additional Mathematics learning. Therefore, their responses were likely based on actual experience rather than only on their expectations of GenAI. The existing familiarity with these tools may also help explain why perceived usefulness and attitude were important in shaping behavioural intention, as students had opportunities to evaluate GenAI based on their actual learning experiences.

The significant relationship between perceived ease of use and perceived usefulness supports H1 and is consistent with Demir (2026). This suggests that when students find GenAI straightforward to interact with, they are more likely to recognise its value for learning Additional Mathematics. The demographic profile provides useful context for this relationship, as almost all respondents (95.4%) had previous experience using AI for studying Additional Mathematics. In addition, 73.3% reported using GenAI either sometimes or often, indicating that many students had sufficient exposure to these tools to evaluate how easily they could be used for learning. For students preparing for SPM, an accessible GenAI tool may be particularly useful when they need quick explanations, worked examples or clarification of difficult mathematical concepts. Thus, students who experience GenAI as requiring less effort may also be more likely to recognise its practical usefulness in supporting their Additional Mathematics learning.

However, perceived ease of use did not have a statistically significant effect on attitude and therefore H2 was not supported and is inconsistent with Demir (2026). although it supports the findings from by Tiwari et al. (2024). One possible explanation may be the students' existing familiarity with AI-based tools. In the present study, 125 out of 131 students (95.4%) had previously used AI for studying Additional Mathematics, while the largest groups reported using GenAI sometimes or often. This suggests that GenAI was not entirely unfamiliar to most participants. Consequently, ease of use may have become less important in shaping their attitudes because students already had experience interacting with such tools. Instead, they may have placed greater emphasis on whether GenAI could provide meaningful support for understanding difficult concepts, solving mathematical problems and preparing for SPM. Thus, among these students, the perceived learning value of GenAI may have been more influential in forming their attitudes than the ease of operating the technology.

Moreover, the significant effect of perceived usefulness on attitude supports H3 and is consistent with Demir (2026). This finding suggests that students who recognise clear academic benefits from using GenAI are more likely to develop a favourable attitude towards the technology. The demographic profile provides useful context for this relationship, as 95.4% of the respondents had previously used AI for studying Additional Mathematics, while 73.3% reported using GenAI sometimes or often. Their prior exposure may have given them opportunities to assess the practical value of GenAI based on their actual learning experiences. For students preparing for SPM, GenAI may be viewed favourably when it helps them understand difficult concepts, obtain explanations, practise questions or explore mathematical solution methods. Therefore, the positive relationship between perceived usefulness and attitude may reflect students' recognition of the learning benefits that GenAI can provide in their Additional Mathematics studies.

Furthermore, the significant effect of perceived usefulness on behavioural intention supports H4 and is consistent with Setälä et al. (2025) and Xie et al. (2026). Most respondents had already experienced using AI for Additional Mathematics, while nearly three-quarters reported using GenAI sometimes or often. Their intention to use GenAI may therefore be based on an existing understanding of what the technology can offer rather than simply on curiosity about a new technology. For students preparing for SPM, this may be especially important because they have specific academic demands and may seek additional support outside regular classroom instruction. If their previous experiences show that GenAI can help with practising questions, clarifying mathematical concepts, checking their understanding or exploring alternative solution approaches, they may be more willing to continue using it. Hence, students' behavioural intention appears to be closely related to the learning benefits they associate with GenAI.

Similarly, the significant effect of attitude on behavioural intention supports H5 and is consistent with Sun et al. (2025). The students' prior experience with GenAI may have contributed to the formation of these attitudes. As most respondents had already used AI for Additional Mathematics and many reported using GenAI with some regularity, they had opportunities to develop personal evaluations of the technology based on their learning experiences. When these experiences are perceived positively, students may be more willing to continue incorporating GenAI into their study activities. This may be particularly relevant among students preparing for SPM, where continued practice and access to additional learning support can be important. Therefore, a favourable attitude towards GenAI may translate into a stronger intention to use the technology for Additional Mathematics, particularly when students regard it as a useful complement to their existing learning practices.

The use of multiple GenAI platforms also provides further context for the findings. ChatGPT and Gemini were the most commonly reported tools, while some students reported using combinations of different platforms. This suggests that respondents had exposure to different GenAI tools rather than relying on a single platform. Their behavioural intention may therefore reflect accumulated experiences with GenAI for Additional Mathematics rather than responses to an entirely unfamiliar technology.

Overall, the results provide support for four of the five proposed relationships in the TAM framework. Perceived ease of use significantly influenced perceived usefulness, while perceived usefulness significantly influenced both attitude and behavioural intention. Attitude also significantly influenced behavioural intention, whereas perceived ease of use did not have a significant direct effect on attitude. The demographic profile provides an important context for interpreting these relationships, as 95.4% of the respondents had previous experience using AI for Additional Mathematics and 73.3% reported using GenAI sometimes or often. Furthermore, the use of different platforms, particularly ChatGPT and Gemini, indicates that the respondents were already exposed to more than one type of GenAI tool. Taken together, the results suggest that these students were not approaching GenAI as an entirely unfamiliar technology. Their behavioural intention may therefore depend more strongly on the usefulness they derive from GenAI and their overall evaluation of its role in learning, rather than simply on how easy the technology is to operate.

CONCLUSION

This study applied the Technology Acceptance Model (TAM) to examine Malaysian secondary students' behavioural intention to use GenAI for learning Additional Mathematics. The results supported four of the five proposed relationships, indicating that perceived ease of use significantly influenced perceived usefulness, while perceived usefulness significantly influenced both attitude and behavioural intention. Attitude also had a significant effect on behavioural intention. However, perceived ease of use did not significantly influence attitude. The structural model demonstrated acceptable predictive performance, with the model explaining meaningful variance in the endogenous constructs and showing predictive relevance. In addition, the demographic results showed that most respondents had prior experience using GenAI for Additional Mathematics and were familiar with different platforms, particularly ChatGPT and Gemini. This suggests that GenAI was already relatively familiar to the students and had begun to form part of their learning practices. Overall, the findings indicate that what GenAI can contribute to students' Additional Mathematics learning may be more important than simply how easy the technology is to use.

RECOMMENDATION

Future studies could extend the present research by involving larger and more diverse samples of Malaysian secondary-school students, including students from different states, school types and academic levels. The present study focused specifically on secondary school students taking Additional Mathematics; therefore, future research could compare students taking different mathematics subjects or students from different forms.

Future researchers could also extend the TAM framework by incorporating other factors that may influence GenAI adoption, such as trust, perceived risk, AI literacy, social influence, perceived enjoyment, facilitating conditions and ethical concerns. These factors may provide a more comprehensive explanation of students' acceptance and use of GenAI.

Finally, future research could examine actual GenAI usage over a longer period rather than focusing primarily on behavioural intention. A longitudinal approach could help determine whether students who express a strong intention to use GenAI actually continue using it and whether such use contributes to their learning outcomes in Additional Mathematics.

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