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Exploring foundation students' AI math tool preferences, duration of use, and confidence in mathematics problem-solving

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ABSTRACT

Artificial Intelligence (AI) tools are increasingly integrated into mathematics education due to features such as step-by-step solutions and interactive feedback. As students often face challenges in mastering mathematical concepts, this study explores the preferred AI math tools among foundation students at the University of Technology Sarawak (UTS), assessing their potential as self-study aids for both independent learning and classroom use. It also investigates how long students have been using these tools and whether their confidence in solving mathematical problems correlates with the duration of use. A total of 340 students from the Foundation in Arts (FIA) and Foundation in Science (FIS) programmes participated in a quantitative, cross-sectional survey. Descriptive statistics were used to examine tool preferences and usage patterns, while Spearman's rank correlation was applied to explore the relationship between confidence levels and AI tool usage duration. Findings indicate that ChatGPT is the preferred tool, followed by Photomath and CameraMath. Most students identified as relatively new users, with the majority having used AI tools for less than six months. While confidence in problem-solving showed a modest increase with longer usage, the correlation was weak and statistically insignificant. These results suggest that although AI tools are widely adopted, their impact on student confidence remains limited.

Keywords: artificial intelligence, ChatGPT, mathematics, education, confidence level, foundation students

INTRODUCTION

Background of the Study

Mathematics is widely recognized as a challenging subject across all levels of education. Research indicates that difficulties often begin in primary school, where issues such as weak number sense, limited working memory, and poor conceptual understanding can lead to long-term learning challenges (Geary at al., 2020). These issues can persist into higher education, where students encounter more complex problems requiring advanced problem-solving skills and deeper conceptual knowledge (Ding et al., 2025). According to Khan and Ali (2025), foundation-level students frequently struggle due to gaps in fundamental knowledge, diverse learning styles, and low confidence These challenges highlight the need for innovative learning strategies, such as AI-powered math tools, to help students strengthen their mathematical skills.

Artificial Intelligence (AI) has quickly made its mark on education, especially in mathematics learning. Many studies have explored the use of AI math tools. For instance, Khan and Ali (2025) reported that AI tools offer personalized learning experiences and real-time feedback, enabling students to tackle complex problems with greater ease. Mohamed et al. (2024) highlighted that instant solutions, step-by-step explanations, and interactive features make AI tools a valuable alternative to traditional instruction. Borah and Borah (2024) emphasized how AI promotes cognitive and mathematical skill development through adaptive problem-solving strategies. Furthermore, Pepin et al. (2025) stated that integrating AI into math education supports self-regulated learning by allowing students to progress at their own pace with immediate feedback.

AI tools in Mathematics Learning

The integration of AI-powered tools in mathematics education has transformed the way students approach problem-solving. These tools help bridge the gap between abstract mathematical theories and real-world applications, allowing students to engage with complex topics more effectively (Awang et al., 2025). They also support accuracy and understanding by offering guided practice and clear explanations (Bahalkar et al., 2024).

Table 1. Overview of AI math tools

AI Math Tool	Main Features	Common Uses in Learning	Supporting Research
CameraMath	AI-powered photo solver with graphing and tutoring features.	Scans handwritten or printed math problems for instant solutions.	AcademicHelp (n.d.); Toolify AI (n.d.)
ChatGPT	AI chatbot providing interactive explanations and conceptual guidance.	Assists with step-by-step math explanations and problem-solving strategies.	Asare et al. (2023); Remoto (2024)
Cymath	Algebra and calculus solver with step-by-step solutions.	Supports real-time problem-solving and verification.	Cymath (n.d.); Santos (2022)
Maple Calculator	Symbolic computation and graphing tool for algebra and calculus.	Used for solving higher-level mathematical expressions.	Maplesoft (n.d.); Ogilvie (2016)
Mathway	Step-by-step problem solver covering various math topics.	Helps verify answers and solve problems across multiple domains.	Mathway (n.d.); Santos (2022)
Microsoft Math Solver	Supports handwritten, scanned, and typed input with interactive explanations.	Provides real-time solutions and problem-solving assistance.	Santos (2022); Stefanova and Georgiev (2024)
MyScript Calculator	Handwriting-based calculator that converts equations into digital format.	Used for quick mathematical calculations through handwritten input.	Morais and Jaques (2022); Resende (2023); Santos (2022)
Photomath	AI-based scanner solving handwritten and typed math problems.	Provides step-by-step solutions with explanations.	Opesemowo and Ndlovu (2024); Santos (2022); Soesanto et al. (2022); Stefanova and Georgiev (2024)
Symbolab	Step-by-step solver for algebra, calculus, and trigonometry.	Enhance procedural fluency in solving equations.	Akpan et al. (2023); Makhdum et al. (2023); Stefanova and Georgiev (2024); Symbolab (n.d.)
Socratic	Google AI-powered app with search-based explanations.	Offers conceptual learning through educational resources.	Santos (2022); Stefanova and Georgiev (2024); Yanuarto et al. (2021)
Wolfram Alpha	Computational knowledge engine for symbolic math and data analysis.	Solves complex mathematical problems, useful for higher-level computations.	Santos (2022); Wan Mohd Rosly et al. (2020)

Different AI math tools cater to a range of student needs, from basic calculations to more advanced problem-solving, helping learners build both conceptual understanding and confidence. **Table 1** outlines various AI math tools, highlighting their key features, common uses in learning, and relevant research studies.

LITERATURE REVIEW

Student Preferences for AI Math Tools

The use of AI tools in mathematics education has led to a growing interest in which tools students find most helpful. Among undergraduate students, ChatGPT is often preferred due to its personalized support, real-time responses, and ability to explain complex concepts in accessible language (Chohan & Khan, 2024; Memiş, 2025; Opesemowo & Adewuyi, 2024; Ramprakash et al., 2024). These features also enhance student engagement and comprehension; a benefit observed not only among undergraduates but also among secondary learners who respond positively to similar functionalities. MathGPT, in particular, has gained attention for supporting calculus learning, especially topics like derivatives and rates of change, through interactive guidance (Torres-Peña et al., 2024). While much of the existing research focuses on secondary and undergraduate students, less is known about the preferences and usage patterns of foundation-level learners.

Duration of AI Tool Usage

Recent studies have explored how long students have used AI tools and whether these influences learning outcomes. Xu et al. (2025) found that most students had used AI tools for less than a year, with longer exposure associated with increased confidence and familiarity. Similarly, Abbas et al. (2025) noted that while initial enthusiasm is common, extended use without meaningful pedagogical integration may reduce motivation or lead to excessive reliance on AI-generated answers. However, these findings are primarily focus on university students, leaving a gap in understanding the experiences of foundation-level learners.

Confidence in Problem-Solving Supported by AI Tools

Confidence plays an important role in how well students manage challenges, approach unfamiliar problems, and persist through difficulty (Booc et al., 2024). AI math tools may contribute to improved confidence by offering interactive guidance and timely feedback. Akhtar and Shah (2025) found that real-time support from AI platforms helped students feel more capable in solving problems. Canonigo (2024) observed that AI-assisted learning bridges abstract concepts with practical applications, fostering conceptual understanding and enabling students to grasp difficult topics and apply their knowledge with greater confidence. Rane (2023) demonstrated that AI-driven learning environments not only improve problem-solving accuracy but also enhance confidence as students become more familiar with the tools.

Yavich (2025) suggested that AI-driven systems can be particularly effective in supporting underprepared university students, helping them manage math anxiety and build confidence. Lin et al. (2024) further showed that guided error analysis using GPT-4 improved accuracy and strengthened students' confidence. Despite these findings, Elvina (2025) and Zhang (2024) cautioned that the long-term impact of AI tool usage on sustained confidence is still uncertain, pointing to the need for further investigation.

Although this study does not assess long-term confidence retention, it aims to assess whether a correlation exists between duration of AI tool usage and students' confidence levels at a specific point in time.

RESEARCH GAP

Although previous studies have examined AI-based educational tools (Haleem et al., 2023), user preferences in AI adoption (Qin et al., 2024), and AI chatbots in mathematics learning (Cheng et al., 2024), these studies mainly focus on secondary and undergraduate students. They do not specifically address foundation-level learners or explore their preferences, duration of AI tool usage, and confidence in solving mathematical problems. Therefore, this study seeks to fill this gap by analysing which AI math tools are most preferred by foundation students, how long they have been using them, and whether greater problem-solving confidence correlates with a longer history of AI tool usage.

PURPOSE OF THE RESEARCH

This study aims to explore foundation students' AI math tool preferences, examine the duration of their AI tool usage, and explore whether their confidence in solving mathematical problems is correlated with AI tool usage duration. The research questions are as follows:

RQ1 Which AI math tools do foundation students prefer?

RQ2 How long have students been using AI math tools?

RQ3 Does students' confidence in problem-solving correlate with the duration of their AI tool usage?

METHODOLOGY

Study Design and Research Approach

This study employs a quantitative, cross-sectional research design using a survey-based approach to examine foundation students' preferences for AI math tools, how long they have been using these tools, and their self-reported confidence in problem-solving. A quantitative approach was chosen because it enables the numerical measurement of AI tool preferences, duration of use, and confidence levels. This approach allows for descriptive analysis of AI tool preferences and statistical examination of correlations between confidence levels and AI tool usage duration.

In addition, a cross-sectional design was used as it captures data at a single point in time, making it suitable for assessing current AI tool preferences, how long students have been using AI tools, and their confidence levels. A non-experimental, correlational approach was employed to examine whether higher confidence in problem-solving correlates with a longer duration of AI tool usage, without manipulating any variables. Since this study does not involve intervention or experimental control, a non-experimental design is appropriate for observing naturally occurring patterns in AI tool usage.

A correlational approach was chosen to examine whether students' confidence levels correlate with the duration of AI tool usage. However, correlation does not imply causation—while the study may identify a correlation between confidence and AI tool usage, it does not establish that using AI tools directly causes an increase in confidence.

Research Context

This study was conducted at the University of Technology Sarawak (UTS), School of Foundation Studies, which offers two foundation programmes: Foundation in Arts (FIA) and Foundation in Science (FIS). This study focuses on foundation students as it aims to explore their usage of AI math tools.

Participants and Sampling

This study involved 340 foundation students who were randomly selected to respond to an online survey. Participants were from both the Foundation in Arts (FIA) and Foundation in Science (FIS) programmes. A simple random sampling method was used, where a group of foundation students was chosen as the target population, and participants were randomly selected from this group. This method ensured that every student in the group had an equal chance of being chosen, enhancing the representativeness of the sample while minimizing selection bias. All responses were analysed as received, without adjustments to balance representation.

Questionnaire Design and Validity Considerations

The questionnaire for this study was created specifically for this research. However, its design was guided by key concepts from well-established scales, particularly the Mathematics Self-Efficacy Scale (MSES) and the Fennema-Sherman Mathematics Attitudes Scale (FSMAS). The MSES, developed by Betz and Hackett (1983), assesses students' confidence in solving mathematics problems, while the FSMAS, created by Fennema and Sherman (1976) examines both their confidence and anxiety related to mathematics.

Table 2. Comparison of questionnaire constructs with existing validated scales

Key Concept	Mathematics Self-Efficacy Scale (MSES)	Fennema-Sherman Mathematics Attitudes Scale (FSMAS)	Current Study Questionnaire
Math Problem-Solving Confidence (Q5)	I can solve math problems without help.	I am confident in my ability to learn math.	Q5: Using AI math tools has significantly improved my confidence and ability to solve mathematics problems.
Perceived Effectiveness of Math Learning (Q9)	I can understand new math concepts easily.	I enjoy learning math.	Q9: AI math tools can greatly improve the development of problem-solving skills.
Mathematical Reasoning and Critical Thinking (Q10)	Mathematical tools help me understand concepts.	Using the right resources makes math easier.	Q10: AI math tools have a positive impact on enhancing critical thinking skills.

To ensure alignment with these frameworks, three key questions from the questionnaire (Q5, Q9, and Q10) were selected for analysis. These questions focus on students' perceptions of AI math tools in improving confidence, problem-solving skills, and critical thinking. **Table 2** compares these survey items with related constructs from the MSES and FSMAS, highlighting their connection to established measures in mathematics education research.

Data Collection

The data were collected using a questionnaire survey as a measurement tool to assess foundation students' AI math tool preferences, duration of AI tool usage, and confidence in problem-solving. The survey included a combination of multiple-choice and Likert-scale questions to provide a comprehensive evaluation of students' experiences with AI math tools.

The survey was divided into two parts. Part I collected demographic information, including students' foundation programme. Part II focused on three key aspects:

1) Students' top three preferred AI math tools (without ranking)
2) The duration of AI tool usage, which was categorized into five-time frames (less than 6 months, 6 months to less than 1 year, 1 to less than 2 years, 2 to less than 3 years, or 3 years and above)
3) Three statements designed to assess students' confidence in problem-solving, measured on a 4-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree).

Data Analysis Methods

Descriptive statistics were used to summarize students' AI tool preferences and compare them between foundation programmes (FIA and FIS). The frequency distribution of AI tool usage duration was also analyzed to provide an overview of how long students have been using AI tools. To assess students' confidence in problem-solving, responses to the following three survey questions were analyzed:

Q5: Using AI math tools has significantly improved my confidence and ability to solve mathematics problems.

Q9: AI math tools can greatly improve the development of problem-solving skills.

Q10: AI math tools have a positive impact on enhancing critical thinking skills.

Each of these questions was measured on a 4-point Likert scale, and the scores were summed to generate a confidence score for each student. To ensure the reliability of this score, Cronbach's Alpha test was conducted to assess the internal consistency of the confidence-related items. A Spearman's correlation matrix was also generated to explore how the confidence-related questions were linked. Finally, Spearman's rank correlation test was used to examine whether students' confidence levels were correlated to the duration of AI tool usage and to measure the strength and direction of this relationship.

RESULTS AND DISCUSSIONS

Most Preferred AI Math Tools by Foundation Students

The results show that ChatGPT is the most preferred AI tool among UTS foundation students, with 284 votes, followed by Photomath with 213 votes and CameraMath with 82 votes. ChatGPT's top ranking is likely because it provides detailed explanations for mathematical problems, making it a helpful tool for students at all skill levels. This aligns with research suggesting that ChatGPT enhances problem-solving and conceptual understanding by improving creative thinking, supporting metacognitive processes, and demonstrating effective problem-solving capabilities (Contel & Cusi, 2024; Urban et al., 2024).

Photomath is also widely used, largely because of its visual approach, which lets students scan handwritten or printed equations and instantly see step-by-step solutions. Studies have found that Photomath keeps students engaged, improves problem-solving skills, and makes complex math concepts easier to understand (Adamu & Muhammad, 2024; Solfitri et al., 2024).

Aside from these top choices, other AI math tools like Microsoft Math Solver (71 votes) and Mathway (67 votes) are also commonly used. These tools offer additional features, such as graphing functions and algebraic equation solvers, to support different student needs. Research has shown that Mathway (n. d.) is particularly useful for solving algebraic equations and creating graphs, while Microsoft Math Solver helps students visualize problems through its graphing tools and step-by-step solutions (Santos, 2022; Stefanova & Georgiev, 2024). The preference for these tools suggests that students value platforms that offer clear, structured explanations rather than just direct answers.

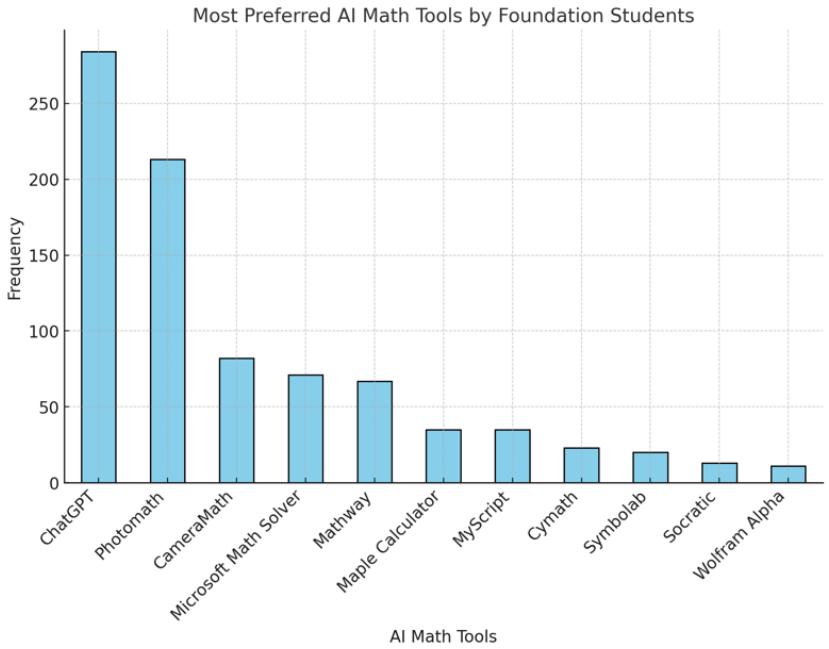

Figure 1. Most preferred AI math tools by foundation students (Source: Authors' own elaboration)

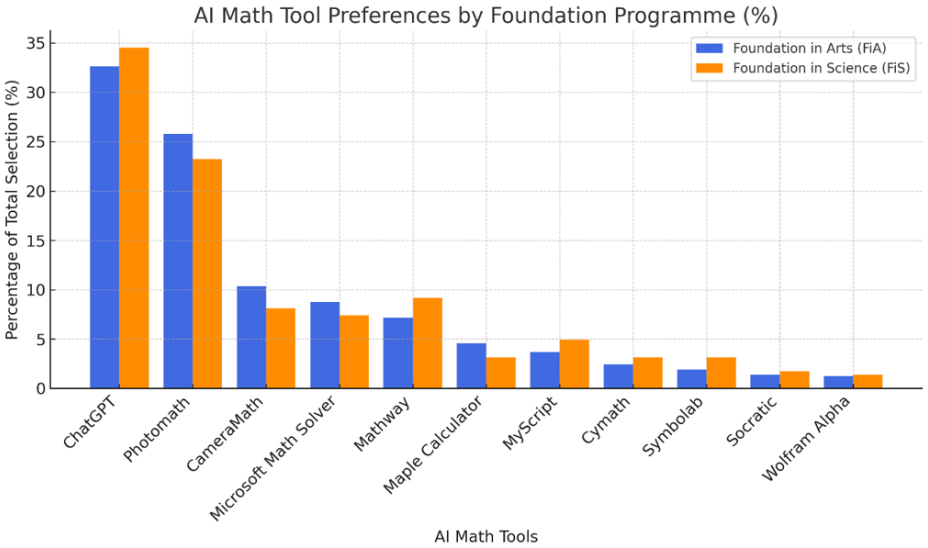

Figure 2. AI math tools preferences by foundation programme (Source: Authors' own elaboration)

Figure 1 shows that ChatGPT and Photomath are the most preferred AI math tools among foundation students. This suggests a strong preference for these tools over others.

AI Math Tool Preferences by Foundation Programme

The analysis of AI math tool preferences among students in the Foundation in Arts (FIA) and Foundation in Science (FIS) programmes reveals broad similarities, with some variations in specific tool preferences. As shown in **Figure 2**, students across both programs rely heavily on ChatGPT and Photomath, while other tools such as CameraMath, Mathway, and Microsoft Math Solver are used less frequently but still remain notable choices.

ChatGPT is the most widely used AI math tool, accounting for 32.63% of total selections in FIA and 34.51% in FIS. This indicates that students from both programs value its step-by-step explanations, problem-solving capabilities, and accessibility. Similarly, Photomath ranks second, making up 25.79% of FIA selections and 23.24% of FIS selections. The high usage of these two tools suggests that most foundation students prefer AI tools that provide instant solutions and explanations for mathematical problems.

Beyond these top choices, some minor variations emerge. Mathway is slightly more popular among FIS students (9.15%) compared to FIA students (7.19%), possibly because FIS students deal with more structured and technical problem-solving approaches. On the other hand, FIA students showed a slightly higher preference for CameraMath (10.35%) and Microsoft Math Solver (8.77%). These differences may indicate that FIA students explore a wider range of AI tools, while FIS students may prefer AI tools that align with formula-driven and systematic problem-solving methods.

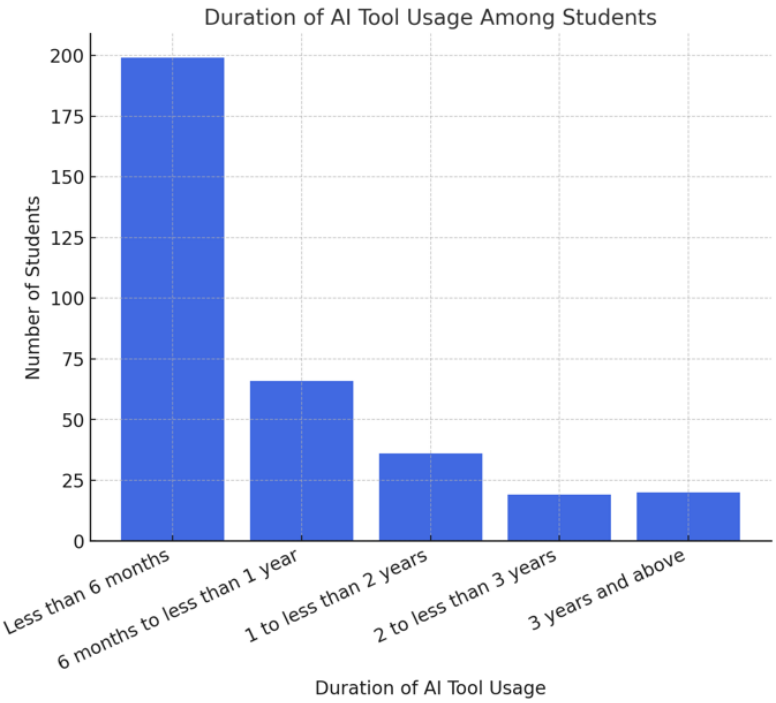

Figure 3. Duration of AI tool usage among students (Source: Authors' own elaboration)

Other AI tools, such as MyScript, Cymath, and Symbolab (n. d.), were used by a smaller percentage of students, with FIS students slightly favouring MyScript (4.93%) and Symbolab (3.17%). These tools are commonly associated with symbolic computation and step-by-step algebraic manipulation, which may be more relevant to science-based subjects.

Overall, FIA and FIS students have similar preferences when it comes to AI math tools. Both groups mainly use ChatGPT and Photomath, with some minor differences in their other choices. These variations could be due to differences in their coursework, study habits, or the types of math problems they typically work on.

Duration of AI Tool Usage Among Students

The data shows that most students are relatively new to AI math tools, with a large portion having started using them in the past six months. In total, 199 students— the largest group of respondents—reported using these tools for less than six months. This suggests that AI-driven math tools have only recently gained widespread popularity among foundation students. A systematic review by Awang et al. (2025) highlights that the adoption of AI technologies in mathematics education has accelerated in recent years, particularly with advancements in AI-powered tutoring and problem-solving tools. Similarly, the U.S. Department of Education (2023) emphasizes the growing investment and interest in AI applications within education, further supporting the notion that AI-driven learning tools have only recently become mainstream.

Following this, 66 students have used AI math tools for six months to less than a year, reinforcing the idea that most users are still in the early stages of integrating these tools into their studies. The number drops to 36 students for those who have used them for one to less than two years, followed by 19 students in the two to less than three years category, and just 20 students who have been using them for three years or more.

Figure 3 shows a clear drop in the number of long-term users, suggesting that AI math tools have only recently become widely used for learning. At the same time, the large number of new users indicates a rising trend in AI tool adoption, likely due to greater awareness, improved technology, and easier access. Studies suggest that improved accessibility, such as enhanced internet connectivity and institutional support, has significantly increased student engagement with AI tools (Popenici & Kerr, 2017). Additionally, free access to AI tools has made these technologies more widely available, further driving their adoption in education (Sova et al., 2024).

Confidence in Mathematics Problem-Solving and AI Tool Usage Duration

The findings indicate that students who have used AI tools for a longer time tend to have slightly more confidence in mathematics problem-solving. As shown in **Figure 4**, students with less than six months of AI tool usage reported an average confidence score of 8.86, while those with three years and above of usage had a slightly higher confidence score of 9.60. However, despite this gradual increase, the overall difference in confidence levels between new and long-term AI tool users remains relatively small.

One interesting observation is that students who have been using AI tools for six months to less than one year reported the lowest confidence scores (8.52). This suggests a possible adjustment phase, where students might initially struggle to integrate AI tools effectively into their learning process. Research has shown that students often face challenges in adopting AI-powered learning tools, requiring time to adjust before fully benefiting from them (Eltahir & Babiker, 2024; Zhai et al., 2024). As they gain more experience, their confidence levels appear to stabilize and slightly improve.

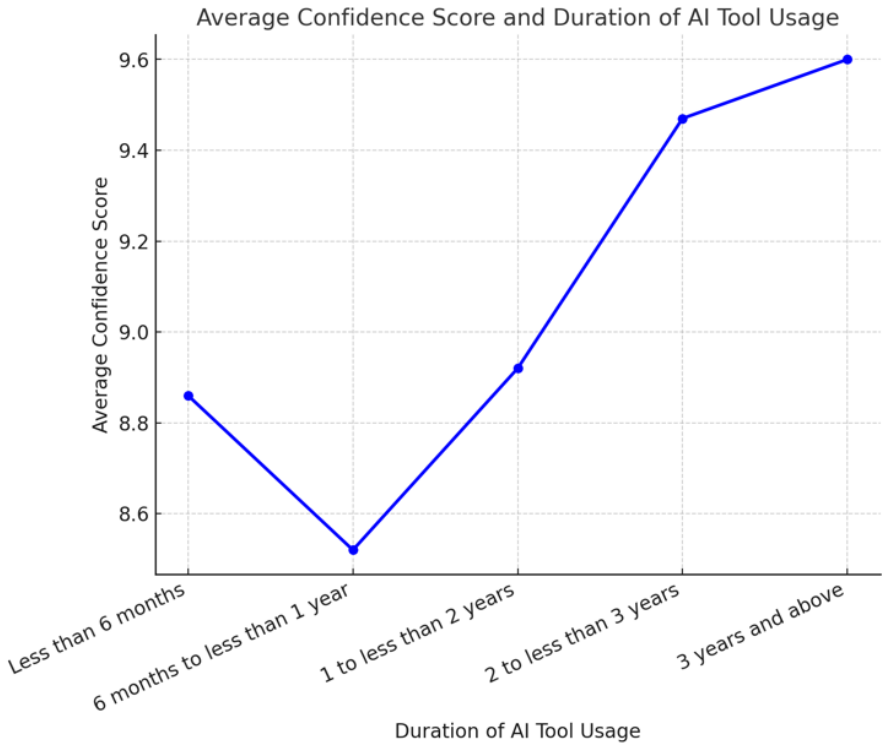

Figure 4. Average confidence score across different duration of AI usage (Source: Authors' own elaboration)

Table 3. Spearman correlation matrix for confidence score items

Survey Question	Q5	Q9	Q10
Q5	1.000	0.630	0.616
Q9	0.630	1.000	0.646
Q10	0.616	0.646	1.000

To measure confidence in problem-solving, a confidence score was calculated based on students' responses to three survey questions: Q5 (Math Problem-Solving Confidence), Q9 (Perceived Effectiveness of Math Learning), and Q10 (Mathematical Reasoning and Critical Thinking). Each question was rated on a 1 to 4 Likert scale, with higher scores indicating greater confidence. The total confidence score was then calculated as follows:

$$Confidence\ Score = Q5 + Q9 + Q10 \quad (1)$$

Since each question has a possible score between 1 and 4, the minimum possible confidence score is 3 (if a student selects 1 for all questions), while the maximum possible score is 12 (if a student selects 4 for all questions). By summing these responses, a comprehensive measure of students' confidence levels was obtained.

Before analysing confidence levels, the confidence score was validated to ensure its reliability and consistency. A Cronbach's Alpha Test was conducted, yielding a high internal consistency score of 0.828, confirming that Q5, Q9, and Q10 measure the same underlying confidence construct and show that the confidence score is statistically reliable. Additionally, Spearman's Correlation Matrix was generated to assess the relationships between Q5, Q9, and Q10. The results, as shown in **Table 3**, indicate moderate correlations between the three items (0.62 – 0.65), further supporting their alignment in assessing problem-solving confidence.

With the confidence score validated for reliability, the final step was to examine whether it correlates with AI tool usage duration. A Spearman's Rank Correlation Test was conducted, as it is appropriate for analyzing relationships between continuous ordinal data (summed Likert-scale confidence scores) and ordinal data (AI tool usage duration which categorized less than 6 months, 6 months to less than 1 year, etc).

The results of the test showed that Spearman's Correlation Coefficient (ρ) was 0.0376, indicating a very weak positive correlation. The p-value was 0.4890, which is greater than 0.05, meaning the correlation is not statistically significant. The correlation coefficient being close to zero suggests that there is almost no relationship between how long students have used AI tools and their confidence in problem-solving. Furthermore, the lack of statistical significance implies that any observed changes in confidence levels could be due to random variation rather than a true effect of AI tool usage.

CONCLUSIONS AND RECOMMENDATIONS

This study found that ChatGPT is the most preferred AI math tool among foundation students at UTS, with both FIS and FIA students favouring it over other options. Notably, most students were also relatively new to AI math tools, with the majority having used them for less than six months. Although students who had used AI tools for a longer time reported slightly higher confidence levels in problem-solving, the difference remained minimal. This suggests that confidence may depend more on factors rather than just AI tool usage.

Despite this, students' preference for AI tools like ChatGPT suggests they could be useful for self-study. However, to successfully integrate them into the classroom, proper planning and support may be needed to make the most of their benefits. Future research could look into how students' confidence changes with continued AI use and how AI tools can be effectively integrated into learning. A longer-term study could also provide deeper insights into their impact over time.

CONTRIBUTION TO THE LITERATURE

This study adds to the existing literature on AI in mathematics education by focusing on foundation-level students, a group that has not been widely studied. While many previous studies have focused on secondary and undergraduate learners, this research offers a closer look at how foundation students engage with AI math tools. It provides data on their tool preferences, how long they've been using these tools, and whether their confidence in solving math problems is linked to usage duration. By using a quantitative approach, the study presents a clearer picture of current usage trends among early tertiary learners. The findings also suggest that while AI tools like ChatGPT are popular, their actual impact on student confidence is still limited. This highlights the need for further research into how these tools can be better used to support learning. Overall, the study offers useful insights for educators and curriculum planners who are considering the integration of AI tools in foundational mathematics education.

Author contributions: GL: conceptualization, methodology, writing - original draft, writing - review & editing, visualization, supervision, project administration, funding acquisition; **THE:** software, validation, formal analysis, data curation, writing - original draft; **CTM:** investigation, resources, writing - original draft. All authors have agreed with the results and conclusions.

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Ethical statement: The authors stated that formal ethics committee approval was not obtained because this study used a non-experimental, survey-based approach with anonymous responses, did not involve any interventions, and did not collect sensitive personal data. The authors followed ethical guidelines to protect participant anonymity and keep all data confidential. Before taking part, students were informed that the survey was for research purposes only and that no personal or identifiable information would be collected. The authors further stated that participation was voluntary, and informed consent was obtained before data collection. Students had the right to refuse or withdraw from the study at any time without any consequences. All responses remained confidential, and the data collected were used strictly for academic research.

AI statement: The authors stated that ChatGPT (OpenAI, 2025) was used solely for language refinement and grammar checking during the preparation of this manuscript. No AI technologies were involved in the study design, data collection, analysis, or interpretation.

Declaration of interest: No conflict of interest is declared by the authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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