"AI In Mathematics Education: Level of Awareness and Perceptions on the Usefulness of AI-Driven Learning Tools Among Grade 12 STEM Students"

Avanceña, Mary June G.; Bandong, Rosauro Jr., S.; Carbaquil, Kyla Marie T.; and Genesis G. Camarista, Ph.D.

West Visayas State University-Himamaylan City Campus, Philippines

DOI: https://doi.org/10.51244/IJRSI.2025.120800168

Received: 12 Aug 2025; Accepted: 18 Aug 2025; Published: 17 September 2025

ABSTRACT

This study examined the awareness and perception of Artificial Intelligence (AI)-driven learning tools among Grade 12 STEM students in mathematics education. AI technologies, increasingly integrated into classrooms, offer personalized learning, immediate feedback, and adaptive instruction. Using a quantitative descriptive-correlational design, the study surveyed 63 STEM students from the only two secondary schools in Himamaylan City offering the STEM strand during Academic Year 2025–2026. A researcher-developed Likert-scale questionnaire measured students' awareness of and perceptions toward AI-driven tools. Descriptive statistics, Mann-Whitney U tests, and Spearman's rho correlation were employed for analysis. Findings revealed that students were highly aware of AI-driven learning tools ($M = 4.19$, $SD = 0.54$) and held an appreciative perception of their usefulness ($M = 3.68$, $SD = 0.66$). No significant differences in awareness or perception were found when classified by sex or socioeconomic status, suggesting equitable access to AI tools across demographic groups. The absence of SES-related disparities may be attributed to school-provided resources and inclusive technology policies. A moderate positive correlation ($\rho = 0.424$, $p = .001$) was found between awareness and perception, indicating that greater familiarity with AI is associated with more positive evaluations of its usefulness in mathematics learning. The results underscore the readiness of STEM students for AI integration, highlighting that access alone is insufficient—critical engagement, ethical understanding, and skillful application are essential for maximizing AI's educational potential. These findings support the need for AI literacy programs embedded within curricula to promote informed, equitable, and effective adoption of AI technologies in secondary mathematics education.

Keywords: Artificial Intelligence (AI); STEM Education; Mathematics Learning; Awareness and Perception; AI-Driven Learning Tools

INTRODUCTION

In today's rapidly evolving world, driven by continuous technological advancements, Artificial Intelligence (AI) has emerged as a transformative force across various sectors, including education. As societies increasingly rely on digital technologies, AI offers adaptive and intelligent solutions tailored to the dynamic needs of learners and educators (Holmes, Bialik, & Fadel, 2019). AI systems are capable of performing tasks that typically require human intelligence, such as natural language understanding, pattern recognition, problem-solving, and decision-making (Russell & Norvig, 2021). Within the educational landscape, AI facilitates personalized learning experiences, delivers immediate feedback, and enhances outcomes for both students and educators (Luckin & Holmes, 2016).

Initially applied to automate grading and administrative tasks, AI has evolved significantly due to advances in machine learning and natural language processing. These developments have given rise to adaptive learning platforms that customize educational content to individual learning styles while addressing both cognitive and emotional aspects of student engagement (Luckin et al., 2016; Roll & Wylie, 2016; Holmes et al., 2019).

In mathematics education, AI-powered tools such as intelligent tutoring systems and adaptive platforms provide personalized instruction and timely feedback, which have been shown to improve student engagement and academic performance. However, the success of these technologies hinges largely on the acceptance and active engagement of both students and educators (Opesemowo & Ndlovu, 2024; Opesemowo & Adewuyi, 2024; Chhetri, 2022).

Public perception of AI in STEM education, as reflected in contemporary online discourse, tends to be generally neutral to positive, characterized by optimism, curiosity, and a degree of trust in AI's capabilities (Smith-Mutegi, Mamo, Kim, Crompton, & McConnell, 2025). Nonetheless, ethical concerns persist, including fears of AI misuse, over-reliance on technology, data privacy issues, and the potential displacement of human educators, which continue to fuel ongoing debates (Stefanova & Georgiev, 2024).

These ethical concerns hold particular weight in school settings, where decisions about adopting new technologies often involve balancing innovation with safeguarding student welfare. Issues such as data privacy, equity of access, and the fear of diminishing the teacher's role may shape how readily administrators, educators, and parents accept AI integration in classrooms. Even with clear evidence of AI's potential benefits, hesitation may persist if stakeholders perceive risks as outweighing advantages. As highlighted by Zawacki-Richter et al. (2019), concerns about trust, transparency, and ethical responsibility strongly influence the extent to which AI applications are adopted in educational contexts. Thus, addressing these ethical considerations is not only essential for fostering trust but also for ensuring the sustainable and responsible use of AI in schools.

While AI's benefits, such as reducing cognitive load and providing real-time feedback, are well documented, there remains a notable gap in research regarding how Senior High School students perceive and interact with AI-driven learning tools (Panqueban & Huincahue, 2024). Furthermore, questions about students' trust in AI recommendations and the broader ethical implications of AI in education warrant further exploration.

For the purposes of this study**,** awareness is defined as the extent of Grade 12 STEM students' knowledge and understanding of AI technology, particularly its applications in mathematics education. Perception refers to students' attitudes, beliefs, and opinions concerning the usefulness and effectiveness of AI-driven learning tools.

Gaining insight into students' perceptions of AI in mathematics education is critical, as these views significantly influence their willingness to adopt and engage with such technologies. Moreover, cultural factors, perceived usefulness, and the enjoyment derived from AI tools are important determinants of student acceptance and sustained engagement (Setälä, Heilala, Sikström, & Kärkkäinen, 2025).

This study aimed to address these gaps by examining the levels of awareness and perceptions of AI-driven learning tools among Grade 12 STEM students in the context of mathematics education. By doing so, it seeks to contribute to a deeper and more comprehensive understanding of AI adoption within educational settings.

Specifically, this study seeks to answer the following research questions:

What is the level of awareness of AI-driven learning tools among Grade 12 STEM students when taken as a whole, and when classified by:

Sex

Socioeconomic status (SES)

What is the level of perception of Grade 12 STEM students regarding the usefulness of AI-driven learning tools in mathematics education when taken as a whole, and when classified by:

Sex

Socioeconomic status (SES)

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Level of awareness

Is there a significant difference in the level of awareness of AI-driven learning tools among Grade 12 STEM students when classified by:

Sex

Socioeconomic status (SES)

Is there a significant difference in the level of perception of AI-driven learning tools among Grade 12 STEM students when classified by:

Sex

Socioeconomic status (SES)

Is there a significant relationship between the students' level of awareness and their perception of the usefulness of AI-driven learning tools in mathematics education?

Framework of the Study

This study is grounded in the Technology Acceptance Model (TAM) developed by Davis (1989), which posits that individuals' acceptance of technology is primarily influenced by two key factors: perceived usefulness and perceived ease of use. Perceived usefulness refers to the belief that using a particular technology will enhance one's performance, while perceived ease of use pertains to the degree to which the technology is perceived as effortless to use. Within the context of this study, TAM serves to explain how Grade 12 STEM students form their perceptions of AI-driven learning tools in mathematics based on their awareness of these tools and their beliefs regarding their effectiveness and usability.

To expand the analytical framework, this study also incorporates the Unified Theory of Acceptance and Use of Technology (UTAUT) proposed by Venkatesh, Morris, Davis, and Davis (2003). UTAUT extends TAM by introducing four additional determinants of technology adoption: performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy reflects students' beliefs that AI tools can improve their academic performance, while effort expectancy relates to the perceived ease of using such tools. Social influence accounts for the impact of teachers, peers, and other significant individuals in shaping students' attitudes toward AI technologies. Facilitating conditions refer to the availability of necessary resources, infrastructure, and support that enable technology use.

By integrating both TAM and UTAUT, this study offers a comprehensive framework that addresses both individual perceptions and broader contextual factors influencing Grade 12 STEM students' awareness and perceptions of AI-driven learning tools in mathematics education.

METHODOLOGY

Research Design

This study employed a quantitative descriptive-correlational research design to investigate the levels of awareness and perception of AI-driven learning tools among Grade 12 STEM students, specifically within the context of mathematics education. This design was selected to enable the quantification and statistical analysis of student responses, facilitating the identification of patterns, group differences, and relationships between key variables.

According to Creswell and Creswell (2018), quantitative research involves the objective measurement and analysis of data using statistical methods. It is particularly suitable for educational studies that aim to quantify attitudes, opinions, behaviors, or other clearly defined variables. In this study, the primary variables examined were: (1) students' awareness of AI-driven learning tools, and (2) their perception of the usefulness and effectiveness of these tools in mathematics learning. Both variables were operationalized through measurable indicators in a structured survey instrument, allowing for the collection of standardized data amenable to statistical analysis of trends, correlations, and group differences.

The descriptive component of the design focused on assessing the overall level of students' awareness of AI-driven learning tools, including their general knowledge of AI and its applications in mathematics education. This approach also enabled comparisons across demographic factors such as sex and socioeconomic status (SES). Similar research by Kamoun, El Ayeb, Jabri, Sifi, and Iqbal (2024), as well as Yim and Wegerif (2024), explored AI awareness among diverse student and teacher populations. For instance, Kamoun et al. (2024) examined attitudes toward AI-driven models like ChatGPT among students and faculty, while Yim and Wegerif (2024) assessed teachers' perceptions and readiness to implement AI literacy programs, finding significant variations in awareness linked to prior exposure to AI technologies.

The correlational component examined the relationship between students' awareness of AI and their perceptions of AI-driven learning tools. Correlational research is a non-experimental method that investigates associations between variables without manipulation, allowing researchers to identify patterns and relationships (Sutradhar, Adhikari, Sutradhar, & Sen, 2023). Related studies, such as Marrone, Zamecnik, Joksimovic, Johnson, and De Laat (2024), used a correlational approach to explore students' trust and collaboration with AI systems, revealing that higher AI awareness was associated with more positive perceptions and greater willingness to engage with AI in educational settings.

By integrating descriptive and correlational methods within a quantitative framework, this study offers a comprehensive understanding of how Grade 12 STEM students' awareness of AI varies across demographic groups and how this awareness influences their perceptions of AI-driven learning tools in mathematics education.

The Respondents of the Study

The respondents of this study were Grade 12 students enrolled in the STEM strand, selected from one section in each of the only two secondary schools in Himamaylan City offering the STEM program for the Academic Year 2025–2026. These students were chosen due to their direct relevance to the research objectives, particularly their involvement in mathematics education where AI-driven learning tools may be integrated.

To qualify as respondents, students had to meet the following inclusion criteria:

Currently enrolled as Grade 12 STEM students;

Attending a secondary school within Himamaylan City;

Have exposure to mathematics education incorporating AI-driven learning tools.

Purposive sampling, a non-probability sampling technique, was employed to intentionally select participants based on these specific characteristics relevant to the study (Etikan, Musa, & Alkassim, 2016). This approach ensured that only students with the appropriate educational background and contextual experience were included, thereby enhancing the relevance and richness of the data collected. Given that these sections represented the entire population available and applicable to the study focus, purposive sampling was deemed the most suitable method.

This sampling strategy enabled the researchers to gather comprehensive and representative data on students' awareness and perceptions of AI-driven learning tools in mathematics education. By including the whole population of interest rather than a subset, the study strengthened the validity of its findings within this specific context.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Data Gathering Procedure

Data for this quantitative descriptive-correlational study were collected using a researcher-developed structured survey questionnaire. The instrument was divided into two main sections: the first assessed students' awareness of AI technology and its applications in mathematics education, while the second evaluated their perceptions regarding the usefulness and effectiveness of AI-driven learning tools.

Prior to full administration, the questionnaire underwent expert validation by three mathematics-major teachers with expertise in the field. Their qualitative feedback established content validity and confirmed the clarity and relevance of the items. A pilot test was then conducted with 45 Grade 12 STEM students from schools outside Himamaylan City but with similar academic profiles. Results of the pilot showed that the items were well understood, and no revisions were necessary. Reliability of the instrument was confirmed using Cronbach's alpha, which yielded coefficients of .910 for the awareness scale (21 items) and .948 for the perception scale (18 items), both indicating high internal consistency.

The researchers initiated the data collection process by submitting formal letters of request to the principals of all STEM-offering secondary schools in Himamaylan City. Upon receiving approval, coordination with Grade 12 STEM advisers was arranged to schedule the administration of the questionnaires. Informed consent was obtained from all participants prior to data collection.

On the agreed dates, the researchers personally administered the questionnaires during regular class hours to maximize participation and address any student questions. Completed questionnaires were collected immediately following administration.

The collected data were carefully organized, coded, and entered into a spreadsheet and statistical software to ensure accuracy and confidentiality. Data entry and coding were cross-checked by the research adviser and a statistician for completeness and correctness. The final dataset was then analyzed using appropriate statistical methods aligned with the descriptive-correlational design to determine the levels of awareness, perceptions, and relationships among the variables.

Research Instrument

The primary research instrument for this study was a researcher-developed structured survey questionnaire designed to assess Grade 12 STEM students' awareness of and perceptions toward AI-driven learning tools in mathematics education. The instrument consisted of two components, both measured using a 5-point Likert scale.

Awareness Scale (Cronbach's $\alpha = .910$)

This section measured students' knowledge and understanding of AI-driven learning tools, including general AI concepts and specific applications in mathematics education. Responses ranged from "Fully Aware" to "Not aware at All."

Perception Scale (Cronbach's $\alpha = .948$)

This section assessed students' attitudes, beliefs, and opinions regarding the usefulness and effectiveness of AI-driven tools in mathematics education. Statements covered areas such as learning improvement, personalized instruction, and problem-solving support. Students responded on a 5-point scale ranging from "Strongly Agree" to "Strongly Disagree."

The questionnaire was validated by three mathematics-major teachers through qualitative feedback and pilot-tested with 45 Grade 12 STEM students outside the target population. Since pilot participants demonstrated clear understanding of the items, no revisions were made. The final version of the survey was therefore considered both valid and reliable for assessing awareness and perceptions of AI-driven learning tools in mathematics education.

Data Analysis Method

This study utilized both descriptive and inferential statistical techniques to address its objectives regarding Grade 12 STEM students' awareness and perception of AI-driven learning tools in mathematics education.

In the initial phase, descriptive statistics were employed to summarize and interpret key variables. Measures of central tendency, specifically the mean, were calculated to determine the average levels of awareness and perception among respondents. Standard deviations were used to assess the variability of responses, offering insights into how consistently or inconsistently students rated their knowledge and attitudes. These analyses provided a general overview of the students' understanding of and attitudes toward AI tools in the mathematics classroom.

Descriptive statistics were also applied to examine variations in awareness and perception scores across demographic subgroups, such as sex and socioeconomic status (SES). This step helped identify whether particular demographic factors influenced students' familiarity with or attitudes toward AI-driven technologies.

To determine the relationship between students' awareness of AI tools and their perceptions of these tools in mathematics education, the study employed Spearman's rank-order correlation coefficient (ρ). This non-parametric statistical method was selected due to its appropriateness for analyzing ordinal or non-normally distributed data. It measured the strength and direction of a monotonic relationship between the two variables. A positive and statistically significant correlation would suggest that greater awareness is associated with more favorable perceptions.

Additionally, the Mann–Whitney U test was used to assess whether significant differences existed in awareness and perception scores between independent groups—such as male and female students, or different SES categories. As a non-parametric test, the Mann–Whitney U was appropriate for comparing mean ranks when the assumptions of parametric tests (e.g., normal distribution) could not be met.

All statistical analyses were performed using SPSS (Statistical Package for the Social Sciences). This software was selected for its reliability and widespread use in educational and social science research. SPSS facilitated the computation of descriptive statistics, correlation coefficients, and non-parametric tests, ensuring systematic and accurate interpretation of the data collected.

Ethical Considerations

The researchers upheld the ethical principles of informed consent, anonymity, and data confidentiality throughout the conduct of the study. Respondents were provided with a briefing on the study's purpose, procedures, and their rights, including the right to withdraw at any time without penalty. No personally identifiable information was collected in the survey.

The questionnaire was designed to be respectful and age-appropriate, aligning with ethical standards for research. All responses were kept confidential and were stored in secure digital formats accessible only to the research team and their adviser. The results of the study were reported in aggregate form and were intended solely for academic purposes.

RESULTS AND DISCUSSION

This section presents and interprets the findings of the study on Grade 12 STEM students' level of awareness and perceptions regarding the usefulness of AI-driven learning tools in mathematics education. Using both descriptive and inferential statistical analyses, the results provide insights into students' familiarity with AI technologies and their attitudes toward their application in the classroom. The findings are discussed in relation to existing literature and theoretical frameworks to highlight key patterns, implications, and areas for further inquiry.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

Table 1

The Level of Awareness of Ai-Driven Learning Tools Among Grade 12 Stem Students When Taken as a Whole, and When Classified by Sex and Socioeconomic Status

Variable	Category	n	Mean	SD	Description
Sex	Male	27	4.27	.48	Highly Aware
	Female	36	4.14	.58	Highly Aware
Socio-economic Status	Low	32	4.23	.50	Highly Aware
	High	31	4.16	.59	Highly Aware
As an Entire Group		63	4.19	.54	Highly Aware

Note: 4.51-5.00 Very Highly Aware; 3.51-4.50 Highly Aware; 2.51-3.50 Moderately Aware; 1.51-2.50 Highly Unaware; 1.00-1.50 Very Highly Unaware

The data revealed that Grade 12 STEM students are highly aware of AI-driven learning tools, as reflected by an overall mean score of 4.19 (SD = 0.54). This score falls within the “Highly Aware” range, indicating a strong level of exposure and familiarity with AI technologies in mathematics education across the sample.

Results indicated a slight variation in awareness when classified by sex. Male students achieved a mean score of 4.27 (SD = 0.48), while female students recorded a slightly lower mean of 4.14 (SD = 0.58). Both groups, however, were consistently categorized as “Highly Aware,” suggesting strong overall familiarity with AI-driven learning tools. This minor discrepancy aligns with the meta-analytic findings of Cai, Fan, and Du (2016), who reported that, in general, males tend to hold more favorable attitudes toward technology use than females.

Specifically, the study found that males scored higher in dimensions such as belief in the societal usefulness of technology and self-efficacy, the confidence in one’s ability to effectively learn and utilize technological tools. These attitudinal disparities may stem from persistent social and cultural norms that portray technology as a male-dominated domain, often reinforcing the perception that males are more competent in using technological innovations.

Despite this, the relatively narrow gap in awareness levels in the current study may signal a gradual shift toward gender parity in the adoption and utilization of educational technologies.

Findings also demonstrated comparable awareness levels across socioeconomic status. Students from lower SES backgrounds reported a mean score of 4.23 (SD = 0.50), slightly higher than those from higher SES backgrounds (M = 4.16, SD = 0.59), although both groups fall within the “Highly Aware” category. This result challenges the common assumption that students from higher-income households possess greater familiarity with educational technology.

A likely explanation is the increasing availability of school-provided digital resources. Bulman and Fairlie (2016) explained that when schools ensure consistent access to computers, internet connectivity, and learning software, the influence of household income on technology engagement is significantly reduced. Similarly, Hohlfeld, Ritzhaupt, Dawson, and Wilson (2017) found that students from lower-income backgrounds can achieve comparable levels of technology use when supported by structured school-based programs and equitable access policies.

These findings suggest that institutional access to AI-driven tools within the school environment may be more influential than socioeconomic background in shaping students' awareness. The results support the value of school-level initiatives that promote inclusive and equitable technology integration across all student groups.

The consistently high awareness levels observed across all groups point to the growing presence and normalization of AI tools in the learning environment of STEM students. This trend is in line with Luckin, et al. (2016), who argue that regular interaction with AI in education equips learners with essential 21st-century skills, including adaptive problem-solving and technological fluency.

Nonetheless, the data underscore a critical consideration: awareness must be transformed into competence. As Holmes, et al. (2019) emphasize, students must not only recognize AI tools but also understand their functions, limitations, and ethical implications. To maximize the benefits of AI in education, curriculum designers and educators must integrate structured opportunities for students to apply AI meaningfully in their learning processes.

Overall, the findings affirm that Grade 12 STEM students possess a strong foundational awareness of AI-driven learning tools, regardless of sex or socioeconomic background. This positions them well for more advanced engagement with AI-integrated instruction and suggests a readiness for educational innovation in mathematics.

Table 2 Level of Perception of Grade 12 STEM students Regarding the Usefulness of AI-Driven Learning Tools in Mathematics Classes When Taken as an Entire Group and When Classified as to Sex and Socio-economic Status

Variable	Category	n	Mean	SD	Description
Sex	Male	27	3.74	.69	Appreciative
	Female	36	3.64	.64	Appreciative
Socio-economic Status	Low	32	3.74	.65	Appreciative
	High	31	3.62	.67	Appreciative
As an Entire Group		63	3.68	.66	Appreciative

Note: 4.51-5.00 Advocative; 3.51-4.50 Appreciative; 2.51-3.50 Neutral; 1.51-2.50 Doubtful; 1.00-1.50 Dismissive

The data revealed that Grade 12 STEM students hold a positive perception regarding the usefulness of AI-driven learning tools in mathematics classes. As a whole, the group obtained a mean score of 3.68 (SD = 0.66), which falls under the "Appreciative" category. This indicates that students generally acknowledge the benefits of integrating AI technologies into their learning experience and view these tools as supportive in understanding and engaging with mathematical concepts.

When considered as a whole, the respondents obtained a mean score of 3.68 (SD = 0.66), which falls within the Appreciative range (3.51–4.50). This indicates that, on average, students value and recognize the relevance and benefits of AI-based learning tools in enhancing their mathematics learning experiences. This perception aligns with Bulman and Fairlie (2016), who argued that digital technologies, including AI, improve educational outcomes by promoting personalized learning and engagement, especially in technical subjects like mathematics.

The data show that both male and female Grade 12 STEM students hold an "Appreciative" perception of AI-driven learning tools in mathematics, with males reporting a slightly higher mean (M = 3.74, SD = 0.69) than

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

females (M = 3.64, SD = 0.64). Although not statistically significant, this difference aligns with global trends in gender and AI engagement.

Otis et al. (2024) reported a consistent gender gap in generative AI usage across more than 140,000 individuals. Their findings suggest that women are less likely to use AI tools, even when access is equal. This gap is shaped by social, cultural, and institutional factors, which may also influence how students perceive and engage with AI in education. The slight disparity observed in the current study may reflect these broader dynamics, including differences in confidence and familiarity with technology.

The results showed that low-SES students reported a slightly higher perception of AI-driven learning tools (M = 3.74, SD = 0.65) than high-SES students (M = 3.62, SD = 0.67), although both groups remained in the "Appreciative" category. This suggests that low-SES students may view these tools as more beneficial, likely due to their potential to supplement limited academic support. Eynon and Geniets (2015) explained that digitally excluded youth often develop focused, outcome-driven internet use due to restricted access and fewer support networks. In this context, AI tools may be seen not simply as enhancements but as necessary instruments to meet learning needs.

The slightly higher mean score may also reflect a deeper reliance on technology for academic success among low-SES students. While high-SES students often have broader digital exposure and access to various educational resources, low-SES learners may perceive AI tools as more impactful because they fill critical gaps. The results point to the importance of contextual factors, where access and motivation influence how students evaluate the usefulness of digital learning tools.

Table 3 Differences in the Awareness of AI-driven Learning Tools Among Grade 12 STEM Students

	n	Mean Rank	Sum of Ranks	Mann-Whitney U	Sig
Sex					
Male	27	34.24	924.50	425.50	.400
Female	36	30.32	1091.50		
SES					
Low	32	32.25	1032.00	488.00	.912
High	31	31.74	984.00		

Note: *p < .05 indicates a significant difference

The results of the Mann-Whitney U test reveal no statistically significant difference in the awareness of AI-driven learning tools among Grade 12 STEM students when classified by sex or socioeconomic status. This finding highlights an encouraging trend toward equitable exposure to educational technology across different demographic groups within the senior high school STEM track.

Specifically, the analysis showed that sex does not significantly influence students' awareness (U = 425.50, p = .400). Both male and female respondents demonstrated comparable levels of awareness of AI tools used in mathematics education. This suggests that students, regardless of gender, are receiving relatively uniform access to digital learning platforms that incorporate artificial intelligence. Such parity reflects a broader shift observed in contemporary research. According to the OECD (2018), gender disparities in digital literacy and access to educational technology are steadily diminishing, particularly in STEM-focused environments where instructional tools are distributed more equally.

In terms of socioeconomic status, the data likewise indicate no significant difference in AI awareness between students from low and high SES backgrounds (U = 488.00, p = .912). This outcome is particularly notable

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

given the extensive body of research that has linked SES with disparities in access to technology. Traditionally, students from higher-income families have been more likely to use advanced digital tools due to home access and additional resources. However, the results of this study suggest that school-based interventions and shared digital infrastructures may be mitigating those disparities. Factors such as institutionally provided AI platforms, uniform digital curricula, and public access initiatives may be contributing to a more level playing field. While earlier studies such as Van Deursen and van Dijk (2014) emphasized the negative impact of SES on digital access and skills, more recent efforts are making a measurable difference. For example, UNESCO (2022) reported that many educational institutions have adopted inclusive technology policies aimed at reducing digital inequities by ensuring that all students, regardless of background, can access AI-supported learning tools.

The results showed that the absence of significant differences in AI awareness by sex and socioeconomic status reflects a growing inclusivity in the digital learning environment. As AI continues to shape educational practices, ensuring equal access across student demographics remains critical. These findings suggest that, at least within this sample of STEM students, efforts toward digital equity are yielding positive outcomes, paving the way for more balanced opportunities in technologically enhanced education.

Table 4 Differences in the Perceptions of AI-driven Learning Tools Among Grade 12 STEM Students

	n	**Mean Rank**	**Sum of Ranks**	**Mann-Whitney U**	**Sig**
Sex					
Male	27	33.30	899.00	451.00	.626
Female	36	31.03	1117.00		
SES					
Low	32	33.27	1064.50	455.50	.577
High	31	30.69	951.50		

Note: *p < .05 indicates a significant difference

The analysis aimed to determine whether students' sex or SES significantly influences their perception of the usefulness of AI-driven learning tools in mathematics education.

Results showed no significant difference in the male and female students' perception of the usefulness of AI-driven learning tools (U = 451.00, p = .626). This suggests that male and female students generally perceive AI-driven learning tools in similar ways. This implies that gender does not meaningfully affect how students evaluate or appreciate the usefulness of AI in their academic learning, particularly in mathematics. This is supported by Gerard, J., Singh, S., Macleod, M., McKay, M., Rivoire, A., T. Chakraborty, & Singh, M. (2024), whose study involved 1, 211 higher education students across Northern Ireland and Indi, found no statistically significant effect of gender on perceptions of AI tools after controlling for institution and subject area. Their study suggested that both male and female students had equal opportunities to explore AI tools, leading to similar attitudes toward their usefulness. Likewise, OECD (2018) has documented a narrowing digital gender divide, especially in formal school environments, where both genders increasingly have equal access to digital tools, including AI-assisted learning platforms.

Research by Qazi et al. (2021) showed that gender-related differences in technology use and self-efficacy are generally small and not consistently significant, supporting the view that male students may display slightly higher confidence—but the gap is modest and closing.

In terms of SES, the analysis also revealed no significant difference across groups. This indicates that students from various economic backgrounds perceive AI-driven learning tools similarly in terms of usefulness. This

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue VIII August 2025

could be attributed to equal access provided by the school, such as shared devices, internet access, and institutional platforms that reduce disparities in technological exposure.

While earlier studies (e.g., Van Dijk, 2005) showed that students from higher SES backgrounds tend to have more positive perceptions and experiences with technology due to better access at home, recent efforts to bridge the digital divide may have mitigated this effect. For instance, UNESCO (2022) notes that schools increasingly ensure equal access to digital resources, particularly in STEM-oriented tracks, by integrating AI tools directly into classroom instruction.

Furthermore, Zawacki-Richter et al. (2019) emphasize that when AI tools are embedded within structured learning environments and supported by teachers, students' perceptions tend to converge, regardless of their personal or economic background

Table 5 Relationship Between Students' Awareness and Perception of the Usefulness of AI-driven Learning Tools in Mathematics Education

			Awareness	Perception
Spearman's rho	Awareness	Correlation Coefficient	1.000	.424**
		Sig. (2-tailed)	-	.001
		n	63	63
	Perception	Correlation Coefficient	.424**	1.000
		Sig. (2-tailed)	.001	-
		n	63	63

Note: $p < .01$ – Significant at .01 level

Spearman's rho: ±0.1 to ±0.3 – Small/Weak, ±0.3 to ±0.5 – Medium/Moderate,

±0.5 to ±1.0 – Large/Strong

The result of the Spearman's rho analysis indicates a moderate positive correlation between students' level of awareness and their perception of the usefulness of AI-driven learning tools in mathematics education. The correlation coefficient of 0.424 suggests that as students become more aware of AI technologies and how they function, their perception of these tools as beneficial to their learning also increases. The p-value of 0.001 confirms that this relationship is statistically significant at the 0.05 level, indicating that the observed correlation is unlikely due to chance.

This finding aligns with prior research showing that awareness and familiarity with technology often enhance its perceived usefulness. For instance, Davis (1989) in his Technology Acceptance Model (TAM) emphasized that both perceived usefulness and perceived ease of use influence technology adoption, with awareness playing a critical role in shaping perceptions.

Similarly, Zawacki-Richter et al. (2019) in their systematic review of AI applications in education concluded that a user's awareness and understanding of AI significantly affect their willingness to engage with AI-powered educational tools. They noted that students who are informed about how AI adapts to learning styles, provides immediate feedback, and supports personalized instruction tend to view such tools more positively.

In the context of mathematics education, where abstract concepts and problem-solving skills are central, awareness of how AI can scaffold learning, automate practice, and provide intelligent feedback enhances the perceived value of these tools. For example, Holstein et al. (2019) found that when students understood how AI-powered tutoring systems functioned, their trust in and engagement with the tool increased significantly, leading to more effective use.

Moreover, Chen et al. (2020) discovered that students who had higher exposure to AI-supported platforms in mathematics showed not only improved performance but also a more positive attitude toward such technologies, driven largely by their increased familiarity and understanding.

CONCLUSION

The findings of this study present a compelling narrative of technological readiness and equitable access among Grade 12 STEM students in the context of AI-driven learning tools in mathematics education. The data revealed a high overall level of awareness and a positive perception of usefulness among students, regardless of sex or socioeconomic status. These results suggest that AI technologies are becoming well-integrated into the academic experiences of senior high school learners, reflecting successful institutional efforts to democratize access to digital resources.

No significant differences were found in students' awareness or perception when classified by sex or SES, indicating that barriers traditionally associated with gender and economic background are being mitigated through structured school-based interventions and inclusive digital policies. This progress highlights the growing impact of equitable technology distribution and curriculum standardization in reducing digital disparities. Furthermore, the significant relationship between awareness and perception reinforces the importance of informed exposure, as familiarity with AI tools directly influences students' recognition of their academic value.

These outcomes point to a vital transition in STEM education. It is no longer sufficient for students to merely be exposed to AI tools. To fully realize the educational potential of AI, schools must move beyond access and ensure that learners develop the skills to engage with these technologies critically, ethically, and effectively. Embedding AI literacy, promoting practical application, and fostering reflective understanding will be essential in preparing students to thrive in increasingly AI-enhanced academic and professional environments. The study ultimately affirms that Grade 12 STEM students are not only ready for AI integration but also positioned to become capable and responsible users of these transformative educational tools.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed for educators, school administrators, policymakers, and future researchers:

Integrate AI Education into the STEM Curriculum. Given the high level of awareness and positive perceptions among students, schools may consider formally incorporating AI-related content into the STEM curriculum, especially in mathematics subjects. Lessons could include practical applications of AI-driven learning tools, helping students deepen their understanding and usage of emerging technologies.

Promote Equitable Access to AI Tools Across All Student Groups. Although no significant differences in awareness or perception were observed based on sex or socioeconomic status, efforts may continue to ensure that access remains equitable. Schools should maintain or expand access to digital devices, internet connectivity, and AI-based learning platforms across all student demographics to sustain inclusive and technology-rich learning environments.

Offer Training and Support for Students and Teachers. To maximize the effectiveness of AI tools in the classroom, training sessions or orientation programs may be provided. These should help both students and educators understand how to navigate and fully utilize AI-driven platforms for personalized and interactive mathematics learning.

Encourage Student-Centered and Interactive Use of AI. Educators may design activities that allow students to actively engage with AI tools, such as intelligent tutoring systems or adaptive problem-solving applications. Doing so can enhance not only mathematical understanding but also digital literacy and critical thinking skills.

Monitor and Evaluate AI Integration Regularly. School administrators and IT coordinators may implement mechanisms for regularly assessing how AI tools are used in classrooms, including their effectiveness in improving student engagement and academic performance. Feedback from both students and teachers can guide adjustments to the implementation of these tools.

Support Further Research. Future studies may examine the long-term impact of AI-driven learning tools on academic achievement across various disciplines, not just mathematics. Researchers are encouraged to explore additional variables such as students' motivation, digital literacy, and learning outcomes in AI-integrated environments.

By implementing these recommendations, educational institutions can better prepare students for a future where AI literacy is increasingly essential, while also creating learning environments that are engaging, inclusive, and technologically forward.

REFERENCES

1. Bulman, G., & Fairlie, R. W. (2016). Technology and education: Computers, software, and the internet. In E. A. Hanushek, S. Machin, & L. Woessmann (Eds.), Handbook of the Economics of Education (Vol. 5, pp. 239–280). Elsevier. https://doi.org/10.1016/B978-0-444-63459-7.00005-1]
2. Cai, Zhihui & Fan, Xitao & Du, Jianxia. (2016). Gender and attitudes toward technology use: A meta-analysis. Computers & Education. 105. 10.1016/j.compedu.2016.11.003.
3. Chen, L., Chen, P., & Lin, Z. (2020). AI in Education: A Review. IEEE Access, 8, 75264–75278.
4. Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). Sage Publications.
5. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340. https://doi.org/10.2307/249008
6. Etikan, I., Musa, S. A., & Alkassim, R. S. (2015). Comparison of convenience sampling and purposive sampling. American Journal of Theoretical and Applied Statistics, 5(1), 1–4. https://doi.org/10.11648/j.ajtas.20160501.11
7. Eynon, R., & Geniets, A. (2015). The digital skills paradox: How do digitally excluded youth develop skills to use the internet? Learning, Media and Technology, 41(3), 463–479. https://doi.org/10.1080/17439884.2014.1002845
8. Gerard, J., Singh, S., Macleod, M., McKay, M., Rivoire, A., T. Chakraborty, & Singh, M. (2024). AI Across Borders: Exploring Perceptions and Interactions in Higher Education. arXiv preprint.
9. Hohlfeld, T. N., Ritzhaupt, A. D., Dawson, K., & Wilson, M. L. (2017). An examination of seven years of technology integration in Florida schools: Through the lens of the Levels of Digital Divide in Schools. Computers & Education, 113, 135–151
10. Holmes, W., Bialik, M., & Fadel, C. (2019). Artificial intelligence in education: Promise and implications for teaching and learning. Center for Curriculum Redesign.
11. Kamoun, F., El Ayeb, W., Jabri, I., Sifi, S., & Iqbal, F. (2024). Exploring students' and faculty's knowledge, attitudes, and perceptions towards ChatGPT: A crosssectional empirical study. Journal of Information Technology Education: Research, 23, Article 004. https://doi.org/10.28945/5239
12. Luckin, R., & Holmes, W. (2016). Intelligence unleashed: An argument for AI in education.
13. Marrone, R., Zamecnik, A., Joksimovic, S., Johnson, J., & De Laat, M. (2024). Understanding student perceptions of artificial intelligence as a teammate. Technology, Knowledge and Learning. https://doi.org/10.1007/s10758-02409780-z
14. Organisation for Economic Co-operation and Development (OECD). (2018). Bridging the digital gender divide: Include, upskill, innovate. OECD Publishing.
15. Opesemowo, O. A. G., & Ndlovu, M. (2024). Artificial intelligence in mathematics education: The good, the bad, and the ugly. Journal of Pedagogical Research, 8(3), 333–346. https://doi.org/10.33902/JPR.202426428

16. Otis, N. G., Delecourt, S., Cranney, K., & Koning, R. (2024). Global evidence on gender gaps and generative AI. Berkeley Haas; Stanford University; Harvard Business School.
17. Panqueban, D., & Huincahue, J. (2024). Artificial intelligence in mathematics education: A systematic review. Uniciencia, 38(1), 1–17. https://doi.org/10.15359/ru.38-1.20
18. Roll, I., & Wylie, R. (2016). Evolution and revolution in artificial intelligence in education. International Journal of Artificial Intelligence in Education, 26(4), 582–599. https://doi.org/10.1007/s40593-016-0110-3
19. Qazi, A., Hasan, N., Abayomi-Alli, O., Hardaker, G., Scherer, R., Sarker, Y., … Maitama, J. Z. (2021). Gender differences in information and communication technology use & skills: A systematic review and meta-analysis. Education and Information Technologies, 26(3), 4225–4258. https://doi.org/10.1007/s10639-021-10775-x
20. Russell, S., & Norvig, P. (2021). Artificial intelligence: A modern approach (4th ed.). Pearson Education, Inc.
21. Setälä, M., Heilala, V., Sikström, P., & Kärkkäinen, T. (2025). The use of generative artificial intelligence for upper secondary mathematics education through the lens of technology acceptance. arXiv Preprint. https://doi.org/10.48550/arXiv.2501.14779
22. Smith-Mutegi, D., Mamo, Y., Kim, J., Crompton, H., & McConnell, M. (2025). Perceptions of STEM education and artificial intelligence: A Twitter (X) sentiment analysis. International Journal of STEM Education, 12, Article 9. https://doi.org/10.1186/s40594-025-00527-5
23. Stefanova, T., & Georgiev, S. (2024). Possibilities for using AI in mathematics education. Mathematics and Education in Mathematics, 53, 117–125. https://doi.org/10.55630/mem.2024.53.117-125
24. Sutradhar, A., Adhikari, A., Sutradhar, S., & Sen, S. (2023). Use of correlation analysis in educational research. 5, 731–737.
25. UNESCO IITE & Shanghai Open University. (2022). Advancing Artificial Intelligence-Supported Global Digital Citizenship Education: Global research, policy and practices report. UNESCO Institute for Information Technologies in Education.
26. Van Deursen, A. J. A. M., & Van Dijk, J. A. G. M. (2014). The digital divide shifts to differences in usage. New Media & Society, 16(3), 507–526. https://doi.org/10.1177/1461444813487959
27. Van Dijk, J. (2005). The deepening divide: Inequality in the information society. Sage Publications.
28. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425–478. https://doi.org/10.2307/30036540
29. Yim, I. H. Y., & Wegerif, R. (2024). Teachers' perceptions, attitudes, and acceptance of artificial intelligence (AI) educational learning tools: An exploratory study on AI literacy for young students. Future in Educational Research, 2, 318–345.
30. Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? International Journal of Educational Technology in Higher Education, 16(1), 1–27. https://doi.org/10.1186/s41239-019-0171-0