MESR
منار الشرق للدراسات والأبحاث
Manar Elsharq for Studies & Research
Middle East Journal
of Educational and Psychological Sciences
Homepage:
http://meijournals.com/ar/index.php/mejeps/index
مجلة الشرق الأوسط
للعلوم التربوية والنفسية
ISSN 2789-1828

Exploring Students' Attitudes Toward Integrating Artificial Intelligence (AI) in STEM Learning

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استلام البحث: 10/06/2025 مراجعة البحث: 13/07/2025 قبول البحث: 14/08/2025

ملخص الدراسة:

بحثت هذه الدراسة في تقصي اتجاهات الطلبة نحو دمج الذكاء الاصطناعي في تعليم العلوم والتكنولوجيا والهندسة والرياضيات (STEM). ركزت الدراسة على الاختلافات في المواقف بناءً على الجنس والعمر والخبرة والتخصص الأكاديمي. باستخدام تصميم مسح وصفي، جمعت الدراسة بيانات كمية من 360 طالبًا مسجلين في مساقات متعلقة بالعلوم والتكنولوجيا والهندسة والرياضيات في جامعة إربد الأهلية، الأردن، خلال الفصل الدراسي الثاني من العام الدراسي 2023–2024. جُمعت البيانات من خلال استبيان إلكتروني مُعدّل من أدبيات علمية معتمدة. استُخدم برنامج SPSS الإصدار 23 لتحليل البيانات، وحُسبت المتوسطات الحسابية والانحراف المعياري والرتب وتحليلات التباين المتعددة والمقارنات باستخدام طريقة شيفيه للإجابة على أسئلة الدراسة. تشير النتائج إلى أن الطلاب عمومًا لديهم مواقف إيجابية تجاه استخدام الذكاء الاصطناعي في تعليم العلوم والتكنولوجيا والهندسة والرياضيات بدرجات عالية. ومع ذلك، لم تُعثر على فروق ذات دلالة إحصائية في المواقف بناءً على الجنس والعمر. في المقابل، ظهرت فروق ذات دلالة إحصائية بناءً على الانتماء الجامعي، حيث أظهر طلاب العلوم وتكنولوجيا المعلومات مواقف أكثر إيجابية من أقرانهم في العلوم التربوية.

الكلمات المفتاحية: الذكاء الاصطناعي، العلوم والتكنولوجيا والهندسة والرياضيات، المواقف، التعليم.

Abstract

This study investigated students' attitudes toward integrating Artificial Intelligence (AI) in STEM education. It focused on differences in attitudes based on gender, age, experience, and academic discipline. Using a descriptive survey design, the study gathered quantitative data from 360 students enrolled in STEM-related courses at Irbid National University, Jordan, during the second semester of the 2023–2024 academic year. The data were collected via an online questionnaire adapted from established literature. SPSS Version 23 was used to analyze the data; means, standard deviation, rank and multiple analyses of variance and comparisons using Scheffe's method were calculated to answer the study questions. Results indicate that students generally hold positive attitudes towards the use of AI in STEM education with high grades. However, no significant differences were found in attitudes based on gender and age. In contrast, statistically significant

differences emerged based on college affiliation, with Science and Information Technology students displaying more favorable attitudes than their Educational Sciences peers.

Keywords: artificial intelligence, STEM, attitudes, education.

Introduction

Artificial intelligence (AI) is a rapidly developing field of technology focused on developing clever machines with the ability to perform tasks that involve human intelligence, such as understanding natural language, pattern recognition, and making decisions based on data (Botirovna & Gavkhar, 2025; Ndalu, 2025; Owan et al., 2023; Seyfi et al., 2025). AI is the field of computer science focused on creating computer programs that are capable of imitating clever behavior and hopefully enhancing human-like proficiency (Naqvi, 2020). AI has nevertheless been increasingly integrated and utilized in various industries (Garcia-Madurga & Grillo-Mendez, 2023; Mohebbi, 2025; Suh & Ahn, 2022), and the academic sector is no exception (Nguyen, 2025; Owan et al., 2023). Abrupt increases in technology practices and AI programs have become unavoidable for learning that can provide new innovations to enhance education and teaching (Elham et al., 2023; Jdaitawi, 2023; Jdaitawi et al., 2022; Alzahrani et al., 2023; Jdaitawi et al., 2024; Wang et al., 2023; Yim & Su, 2025).

AI tools such as Bing and ChatGPT have been referred to as devices people can think with, especially in the learning-teaching context for students to increase their level of critical and reflective thinking, creativity, problem-solving, and understanding (Vasconcelos et al., 2023). The use of AI in teaching effectively attained learner-centered learning (Huang, 2018). For instance, AI has also been used in education to contribute towards enhancing the teaching and learning experiences of both teachers and students, such as through facilitation of teaching, learning, decision-making process, students' assessment, support for self-regulation and coordination among

students (Hwang et al., 2020; Holmes et al., 2019; Roll & Wylie, 2016; Self, 2016; Smith et al., 2019; Aleven et al., 2016; Aluthman, 2016). Parallel to the field of education, AI development has unveiled new paths in STEM (Science, Technology, Engineering, and Mathematics) education (Xu & Ouyang, 2022).

Particularly, STEM education seeks to integrate STEM subjects in an attempt to equip students with interdisciplinary subject matter and promote higher-order thinking and problem-solving skills (Kennedy & Odell, 2014; McLaren et al., 2010). The most significant challenges STEM education faces are developing STEM problems, coping with learning by students, and conducting evaluations of their performance (Ouyang, Jiao, Alavi & McLaren, 2023). AI implementation within the educational domain is the solution to solving STEM education development issues using active, interactive and/or adaptive learning environments to produce STEM problems and exercises and act on the students' performance assessments (Alabdulhadi & Faisal, 2021; Jeong et al., 2019; Walker et al., 2014).

Notably, AI has a key role in STEM education, particularly in bringing about personalized learning, advanced analytics and automated instructions (Triplett, 2013), but regardless of the benefits provided by AI to STEM, empirical studies and findings concerning its actual effect, challenges faced during integration and pedagogical methods, related with the domain's implementation are still sadly lacking (Triplett, 2023). Few studies have been carried out on the role of AI in STEM education, although they have supported its implementation in the STEM domain (e.g., Chng, Tan & Tan, 2023; Triplett, 2023). More specifically, studies in the Arab countries are few and far between, to the best of the researcher's knowledge. Thus, this study is significant because it concerns AI application in STEM education to minimize the gap in the

literature. Such a gap stemmed from the studies focused on developing advanced technologies that are not based on the students' attitudes and potential.

Added to this, although AI application in STEM education presents various benefits (e.g., provision of adaptive and personalized learning environment/resources, assisting instructors in understanding behavioral learning patterns of students and performance) (Alabduladi & Faisal, 2021; Walker et al., 2014), it is not necessarily readily accepted by teachers and students, preventing the reaping of the full benefits. Hence, studies dedicated to AI in STEM education need to be enriched from the above perspective in that the focus should be laid on the attitudes of students and the knowledge required to use the benefits of the technology under study. In other words, the experience and the characteristics of students need to be considered for the development of AI use in STEM education – only a few studies were conducted using AI methods have considered the same in STEM and among the few are Göktepe and Göktepe (2023).

Considering the above literature gap, this study mainly aims to determine students' perspectives on AI's potential role in learning and their attitudes toward its implementation as a learning tool. Accordingly, the study examines students' attitudes to illuminate AI's significance in STEM education and its role in enhancing students' skills and knowledge. The study also presents insights and implications to minimize the literature gap through an international discourse on AI in STEM education. The study aims to determine the answers to the following research questions;

1. What is students' attitude towards using AI in STEM courses?
2. Do the students' attitudes toward using AI in STEM courses differ significantly based on gender, age and college?

Literature Review

Attitude towards AI in Education

AI is rarely used, but usage expectations are high compared to present usage (Beege et al., 2024). According to Albaity and Rahman (2019), an attitude refers to the positive or negative feelings of the individuals towards the examined activity, while Awad, Al-Sayyad and Farahat (2020) defined it as the psychological readiness and learned neurological mental preparation for responding to environmental objects, topics, situations, symbols, or to individuals in the environment that requires response. Moreover, Chauhan and Jaiswal (2016) described attitude toward technology as how the individual emotionally responds to using an ICT system. In the same line of study, Bauer (2008) found motivation to use and actual use to influence attitude towards using over time. With regards to the variable's evaluation, Alzahrani (2023) and Geng (2025) explained that this involves the examination of the way people feel about a specific behavior – whether positive or negative and whether or not it will be pleasurable and convenient for them to use. In this regard, positive attitudes promote their enthusiasm towards the behavior, their defense, and their adoption of it in their personalities, owing to their stable and steadfast souls.

On the other hand, negative attitudes would turn them away from believing it, paying any attention to it, or being prepared for it (Tou et al., 2019). Bergdahl & Sjöberg (2025) found that while teachers are optimistic about the potential of AI in education, their AI self-efficacy varies significantly according to their prior use of the AI technology, perceived relevance, and the support available to them. However, Beege et al. (2024) found that teachers revealed that AI has a positive influence on the use and intention to use it, concerns and risks have no significant influence on AI usefulness in the classroom, STEM teachers use AI in the classroom despite potential concerns

and professed risks and they rely on an influence heuristic when judging the utility of AI technology in the classroom.

Specifically, only a few studies have examined students' attitudes towards AI, including Loeckx (2016), who found AI to be an effective tool to minimize the teachers' and students' burden while providing practical learning experiences for the latter. Moreover, researchers were keen to know if AI developments would go against or replace teachers' roles, considering other jobs have already been automated (Lacity & Willcocks, 2017). Consequently, it has been acknowledged that the professional roles of instructors need some modifications to go along with the advances in AI, and this is expected to result in new forms of organizations (Fenwick, 2018). Challenges have also been related to students' attitudes towards the changes (Flogie & Abersek, 2015). At some level, students, being digital citizens, can use AI's full potential to enhance their learning results (Beig & Qasim, 2023). However, suitable use of AI techniques in the learning context would inevitably result in negative attitudes toward learning (Ijaz et al., 2017). AI developments, with the rest of technology, play a key role in education, particularly through advanced software, which attracts students' interest in learning (Beig & Qsim, 2023). Based on the current status, an average individual spends almost 7 hours daily (6 hours and 58 minutes) using the internet (Howarth, 2023). The more individuals are involved with something, the higher their awareness of it increases, shaping their attitude toward AI (Beig & Qasim, 2023).

AI in STEM Education

In STEM education, educational practitioners have found a strategy and approach to developing creative problem-solving among students, providing sufficient opportunities to solve problems by applying knowledge from various disciplines (Basu et al., 2016; Winthrop et al., 2016). The main

objective behind STEM education is to enhance the interdisciplinary knowledge inquiry and application of students while promoting their higher-order thinking, critical thinking, and problem-solving skills (Bybee, 2013; Pimpthong & Williams, 2018). The developments in computer science and computational technologies have resulted in AI technologies that are automated, adaptive, and efficient, and they are currently used in STEM. In other words, AI is quite important in STEM as the primary objective stresses technology use (Huang & Qiao, 2022). Therefore, integrating AI into STEM education would form students' interdisciplinary knowledge and pave the way for discovering various solutions, collaborations and communications in their acquisition of knowledge (Fatimah, Sarwi & Haryana, 2024). It also influences their skills in computing, motivation and learning interests, and self-efficacy (Huang & Qiao, 2022).

Overall, the combination of AI and STEM can satisfy the needs of the students based on individual interests and talents (Huang & Qiao, 2022). AI positively affects the competency of the student (Alkanaan, 2022), and this type of learning (AI with STEM) can lead to increasing the competency of students compared to the traditional type of learning (Huang & Qiao, 2022). Also, Valeri et al. (2025) found that AI tools support the understanding of concepts within STEM subjects for experts and those with limited knowledge of AI students; they demonstrated some effective prompting strategies to generate relevant content. According to Lin et al. (2021), STEM education with AI has been evidenced to enhance students' AI literacy and awareness. Thus, AI complements STEM and can enhance the student's abilities to relate actual life events with theoretical learning (Kong et al., 2021; Jang, Jeon & Jung, 2022). However, more studies are needed to examine the combined elements of AI and STEM education to reach solid conclusions.

Methodology

This study adopted a descriptive survey method to provide a detailed description of the topic under study. It is suitable for the study's purpose, which is to determine the answers to the questions and meet the objectives. The study's main instrument is the questionnaire, which was used to collect descriptive quantitative data concerning the students' attitudes in STEM education towards AI learning tools.

Sample of the Study

The study sample consisted of 360 STEM students in various field courses from two colleges, Educational Sciences and Science and Information Technology, in their second semester (2023-2024) in Irbid National University, Jordan. Following the university's ethical approval, the study tool was distributed electronically to the sample on a Google Drive form. The questionnaire remained available from March 1 to March 3, 2024. The distribution of the members of the research sample based on the examined demographic factors, namely gender, age, experience and college, are tabulated in Table 1.

Table 1. Distribution of the study sample according to demographic variables

Variable	Value Label	N	Percentage %
Gender	Male	157	0.44
	Female	203	0.56
Age	18-20	174	0.48
	Above 20	186	0.52
College	Science and Information Technology	174	0.48
	Educational Sciences	186	0.52
Total		360	100

Tools of the Study

The study developed a questionnaire for assessing students' attitudes concerning the use of AI in STEM education for enhanced learning and continuous usage. Accordingly, items measuring attitude were adopted from relevant literature (Al-Qerem et al., 2023). There were two parts to the instrument; the first covers the response instructions for the measurement items and the demographic details of the sample study, namely gender, age, experience and college. The second part covers the items measuring the variables discerning the use of AI in STEM education. The respondents were requested to provide a sign in front of the 5-point Likert scale (strongly agree, agree, neutral, disagree, and strongly disagree) that they perceived to be appropriate. The conditions laid down by Al-Bawaliz, Arbeyat and Hamadneh (2015) were followed in assigning values to the tool (5, 4, 3, 2 and 1), scores for strongly agree, agree, neutral, disagree, and strongly disagree. Also, for the level of study achievement of the parts of the tool and the overall result, the following scores were appropriate: 1-1.80 (very low level), 1.80-2.60 (low level), 2.60-3.40 (moderate level), 3.40-4.20 (high level) and lastly 4.20-5 (very high level).

Validity of the First Tool

The study instrument was forwarded to ten faculty experts experienced in computer science, networking, ICTs, psychological measurement and evaluation to verify the level to which the items were appropriate individually and as a whole for accurate linguistic formulation and achievement of the study objectives. Following the experts' approval of the tool, its reliability was confirmed through the test-retest method, which was found to be 0.88. The instrument's reliability was also confirmed using Cronbach's alpha internal consistency method, which was found to be 0.79.

Data Analysis

Data was analyzed using SPSS Version 23, the results based upon which the answers to the questions were determined. The answer to the first question was determined by calculating means, standard deviation, and rank. In contrast, the answer to the second question was determined through multiple analyses of variance and multiple comparisons with Scheffe's method.

Results

Results of the first research question: What is the level of attitudes toward using AI among students in STEM courses education?

To answer this question, the means, standard deviations, and rank of the study sample members' responses about their attitudes toward using AI in the learning of students in STEM courses were calculated. Table 2 shows the results.

Table 2. Means and standard deviations of the level of attitudes toward using AI in STEM Education

No.	Items	Means	Standard deviations	Rank	Level
1	I believe STEM students should learn the basics of AI	3.53	1.08	2	High
2	I believe AI will be a highly required tool in my field	3.49	1.26	3	High
3	I believe different students must understand the ethical implications of AI	3.39	1.16	6	Moderate
4	I believe AI will revolutionize the education system	3.56	1.31	1	High
5	I believe human teachers will be replaced in the foreseeable future	3.35	1.26	7	Moderate
6	I believe the upcoming developments in the educational system will excite me	3.39	1.18	6	Moderate
7	I believe AI should be a part of the training system among students in STEM education	3.53	1.18	2	High
8	I believe that AI applications should be integrated into STEM educational curricula	3.46	1.19	4	High

9	I believe that AI is complex and needs more knowledge and expertise	3.44	1.32	5	High
10	I believe that implementing AI in STEM education requires access and technical equipment	3.49	1.19	3	High
	Total degree	3.45	.910		High

From the participants' responses to the attitudes items, the most frequent strongly agree responses were provided for the items "I believe AI will revolutionize the education system" (34.1%) followed by "I believe AI should be a part of the training system among students in STEM education" (33.5%). On the other hand, the most frequent strongly disagree responses were provided for the item "I believe human teachers will be replaced in the foreseeable future" (15.2%). I believe the upcoming developments in the educational system will excite me" (14.7%). Table 2 shows that the total score for the level of attitudes toward using AI in courses related to STEM education, according to the estimates of the study sample members of the students, obtained a mean of (3.45), a standard deviation of (0.91), and a high degree. The means of the study tool items ranged between (3.35-3.56), with high and moderate ratings. Item (4), "I believe AI will revolutionize the education system," came in first place with the highest mean of (3.56) and standard deviation of (1.31) with a high degree. Item (7), "I believe AI should be a part of the training system among students in STEM education," and item (1), "I believe STEM students should learn the basics of AI," scored second and third with a mean (3.53;); next, item (2) "I believe AI will be a highly required tool in my field," item (10) "I believe that implementing AI in STEM education required to access and technical equipment's," item (8) "I believe that AI application should be integrated into STEM educational curricula," item (9) "I believe that AI is complex and need more knowledge and expertise," item (3) "I believe different students must understand ethical implications of AI," item (6) "I believe the upcoming developments in the

educational system will excite me" with a mean of (3.49, 3.49, 3.46, 3.44, 3.39 and 3.39) respectively, and finally item (5) “I believe human teachers will be replaced in the foreseeable future" ranked last with a mean of (3.35) and a medium degree.

Results of the second research question (Do the students' attitudes toward using AI in STEM courses significantly differ based on gender, age and college?

The answer to the second research question entails determining if there are significant differences in the attitudes of the STEM students with AI use, based on their gender and age, whose results are tabulated in Tables 3 and 4, respectively.

Table 3. Differences in the students’ attitudes towards AI in STEM education according to gender

Variable		Mean	SD	t	df	sig.
Attitudes towards AI	Males	3.088	.621			
	Female	3.085	.601	.029	359	.977

Table 4. Differences in the students’ attitudes towards AI in STEM education according to age

Variable		Mean	SD	t	df	sig.
Attitudes towards AI	18-20 years	3.07	.628			
	Above 20 years	3.10	.625	.322	359	.748

No significant difference was found between the means of attitudes towards AI based on gender and age of the studied sample. The results based on gender showed that male students acquired higher mean scores (3.088) with a standard deviation of 0.621 in comparison to female students with lower mean values (3.085) and a standard deviation of 0. 601. The statistical difference was insignificant at the 0.05 level of the independent sample t-test. Thus, no significant difference was found based on the student’s gender regarding their attitude toward AI learning (t=0.029, df=359, p=0.977).

Regarding their ages, based on the values in Table 4, older participants obtained higher attitude mean values at 3.10, with a standard deviation of 0.625. In contrast, their younger counterparts (18-20 years) obtained lower attitude mean values of 3.07 and a standard deviation of 0. .628. However, the result was insignificant at the 0.05 statistical difference of independent sample t-test. In other words, no significant difference was found based on the age of the respondents in light of their attitudes towards AI use in STEM education (t=0.322, df=359, p=0.748).

Table 5. Differences in the students' attitudes towards AI in STEM education according to college

Variable	Mean	SD	t	df	sig.
Attitudes towards AI					
Science and Information Technology	3.48	.676			
Educational Sciences	3.02	.784	.343	359	.000

Table 5 shows that the respondents' college students differed based on their positive attitudes. Science and Information Technology students had the highest positive attitude towards AI use in STEM education. Statistical differences were found at the level of 0.05 using an independent sample t-test.

Discussion

The main objective of this study is to determine the students' attitudes towards AI use in STEM education. Accordingly, the study evaluated the students' attitudes using several measurement items related to their actual experiences of AI use in their STEM courses. Based on the results of the first research question, students in the sample possessed a moderately positive attitude towards using AI in their STEM education, with the majority indicating the importance of AI tools and their extensive implications and applications. Nevertheless, their attitudes may be attributed to

their perceptions and experiences of AI use in learning – this may be exemplified by the disagreement of some students to the statement, “the upcoming developments in the educational system will excite me” and also, “teachers will be replaced in the foreseeable future”. The disagreements with these statements reflect the students’ preferences for traditional teaching strategies. Along a positive line of results, some students agreed that AI would revolutionize the education system. There is a need for more training to enhance the use of AI – in other words, some people are interested in becoming familiar with AI and extending its use to other people for enhanced AI advancement and development (Beig & Qasim, 2023). The results may be attributed to the lack of knowledge concerning the practical implications of AI as evidenced by the traditional curriculum-based STEM education and lack of AI integration in STEM courses rather than the non-integration of AI in STEM courses and limited access to the necessary equipment. In the context of Jordan, a developing nation, AI use still requires extensive training, and universities must provide training programs and seminars concerning AI for students. Also, the students' cultural, instructional and environmental factors may influence their attitudes toward AI use in their STEM courses. In similar studies, Krasovskiy (2020) and Xu and Ouyang (2022) found that achieving high-quality STEM education calls for considering the factors in society and the environment more than focusing solely on the application of AI in educational activities.

Moving on to the second research question, which concerns whether demographic factors, namely gender, age and academic level, affect the students’ attitudes towards AI use in STEM courses, the result indicated to statistically insignificant difference in gender and age, but a significant difference in college. This result may be attributed to similar knowledge concerning AI's role in learning, notwithstanding the gender of the student or their age. Moreover, studies examining students' characteristics and their effects on attitudes toward AI tool usage reported no significant

differences. Similar to this study, Hajam and Gahir (2024) reported no statistically significant difference in university students' attitudes toward AI based on gender. Additionally, Stein et al. (2024) found no significant difference in the same towards AI in learning based on gender, albeit a significant difference was found based on age. Students' perceptions may differ based on their knowledge and technical skills in using AI in their learning activities. As for their college, this study found a significant difference, which may be related to the fact that the curriculum in Science and Information Technology programs often includes direct exposure to AI concepts, tools, and applications, fostering familiarity and competence. Particularly in areas such as data science, programming, and research, this makes them more receptive to its use, which leads to acquiring plenty of experience in using AI tools to complete their projects.

In contrast, students in Educational Sciences may encounter AI only as part of broader discussions around educational technology, often without hands-on experience, leading to limited understanding or interest. Also, in Information Technology programs, students have stronger digital skills and confidence, which enhances their motivation to experiment with and adopt new technologies. On the other hand, Educational science programs often emphasize pedagogy, ethics, and human interaction, which may lead to a more careful or critical position on

Strengths, Limitations and Recommendations

Based on the literature review, the study is one of few studies that examined students' attitudes towards using AI in STEM education as mentioned by past relevant studies (e.g., Chng, Tan & Tan, 2023; Triplett, 2023). Moreover, the existing studies on the effects of students' characteristics on their attitudes toward AI use in STEM education remain lacking. Thus, this study makes a significant contribution to the examined field. Despite several contributions, the study also has

limitations, the scrutiny of which may pave the way for future studies to extend it. One of the top limitations is using the descriptive survey method, with the questionnaire being the sole instrument of data collection from the respondents. Other research methods may be adopted, such as the qualitative method, which uses interviews and observation to determine the nuances of the phenomenon. Also, the study explored gender and age differences in students' attitudes toward AI use, which is largely left untouched in literature. As such, more studies are needed to validate the results. Lastly, due to the small sample size from the university, the generalization of the results is limited; thus, future studies can include large samples to confirm the results. Lastly, universities must establish plans and policies to provide AI training for easy access to more information and promote AI technologies within universities for extended practical and effective use.

Conclusion

The study determined students' attitudes toward AI use in STEM education and the effect of demographic factors on such use. Data was obtained from 360 students using a questionnaire survey as the main data collection instrument. With the dynamic developments of AI technology and its extensive use, students’ attitudes towards using such technology are a significant contribution to the field, and based on this study’s results, attitude is of an overall high level. The study also found that while the gender and age of respondents had no significant differences in the effect of attitudes toward AI learning, college showed significant differences.

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