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Digital Self- Efficacy and Student Engagement in AI-Supported Learning Environment: The Mediating Role of Academic Motivation

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Abstract

This study aimed to explore the correlation between the construct of digital self-efficacy and engagement of students in the context of AI-driven learning environments, while also investigating the potential mediation of academic motivation. The design applied was a descriptive correlational cross-sectional design. The study included a sample of 130 undergraduate students at Al Esraa University who had experience in using AI tools to help in the academic process. A 24-item questionnaire, assessed through three constructs - digital self-efficacy, academic motivation, and student engagement, was used for data collection. Means, standard deviations, Pearson's correlation coefficients, and mediation analysis using Hayes' PROCESS Macro, Model 4, were employed to analyze the data. The results indicated that students possessed high digital self-efficacy and were highly motivated and engaged in learning environments supported by AI. Academic motivation was the highest and positively significant with student engagement, and digital self-efficacy was positively and significantly associated with academic motivation and student engagement. The mediation analysis revealed that digital self-efficacy was partially mediated by academic motivation. The findings pointed out that students' confidence with the use of digital and AI-supported tools had a direct influence on the engagement of students, but also had an indirect effect through strengthening the academic motivation of the students. Overall, the study suggested steps to be implemented to enhance students' confidence, critical evaluation, and motivation while fostering meaningful and responsible interaction with the use of AI in their learning process.

Keywords: *Digital Self-Efficacy, Academic Motivation, Student Engagement, Artificial Intelligence, AI-Supported Learning, University Students.*

Introduction

Artificial intelligence (AI) has revolutionized the world of higher education, influencing the way students gain access to information, get feedback, solve problems, and carry out academic tasks. Personalized support, immediate explanations, and flexible learning opportunities can be provided by Generative AI tools, Intelligent Tutoring Systems, Automated Feedback Applications, and Adaptive Learning Platforms (Dwivedi et al., 2023; Kasneci et al., 2023; Nikolic et al., 2024). But just access to these technologies is not enough to bring meaningful learning. The educative potential of any one of these tools lies in its capacity to be utilized critically, independently, and responsibly by students (Long & Magerko, 2020; Maizel et al., 2026).

Digital self-efficacy is one crucial aspect in the process of effective learning in the context of AI support. Digital self-efficacy is the belief that students can use digital technologies effectively and learn new programs, practice difficult digital tasks, or solve digital problems (Ulfert-Blank & Schmidt, 2022). The idea of self-efficacy (Bandura, 1977, 1997) suggests that self-efficacy impacts choice, effort, persistence, and responses to difficulty. With AI support, digitally self-efficacious students might be more willing to interact with and use AI tools, provide the right prompt, assess information created by AI, and use AI output as a basis for their learning.

Past studies have demonstrated that digital self-efficacy is related to technology acceptance, self-regulated learning, academic achievement, and engagement. Digital competence and self-efficacy were identified as factors to promote students' engagement in technology-supported learning by Getenet et al. (2024). Another study also revealed that digital self-efficacy was correlated with academic achievement and effective

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learning strategies by Widowati et al. (2023). Paredes-Aguirre et al. (2026) discovered that students who had greater digital self-efficacy also reported that the generative AI tools were easier to use, more helpful, and that they had greater intentions to use the tools for learning. Likewise, Zayed and Zayed (2026) found a positive correlation between digital self-efficacy, digital literacy of AI, digital resilience, and academic engagement.

Research that has been conducted in the context of intelligent technologies also suggests that efficacy beliefs have an impact on the interaction of students with intelligent technologies. The results of Siregar et al. (2025) revealed that self-efficacy predicted the use of AI and that the use of AI added value towards learning and achievements. Karama (2026) revealed that the indirect effect of implementing AI on academic achievement was by boosting students' self-efficacy in academic performance. The study conducted by Li et al. (2026) revealed that self-efficacy facilitated SRL tactics to ensure more serious engagement with writing supported by AI. This indicates that when users are more confident in using digital tools, they are more likely to persevere, engage, and put in more work with activities involving AI.

It is a key measure of effective learning that students are engaged. It entails behavioral involvement, emotional involvement, and cognitive involvement in educational activities (Fredricks et al., 2004; Marôco et al., 2020). Engaged students spend time and effort on study, are active contributors, interested in study, and use deep-learning strategies. For meaningful engagement in AI-supported environments, students need to study content created by AI, link it with content taught in class, and make responsible choices for their studies. Engagement was highlighted as crucial in effective technology-enabled learning (Bond et al., 2020), with the four factors of flow, intrinsic motivation, feedback, and perceived usefulness identified as facilitators to building sustained engagement with the AI-enabled platform (Ren et al., 2026).

By increasing their sense of self-efficacy, students are more likely to embrace technology-based tasks with confidence, remaining resilient when met with challenges. Digital self-efficacy can facilitate engagement because students who feel capable of using AI tools are more likely to seek out technology tasks confidently and persevere when faced with challenges. However, it may not be a direct correlation. Academic motivation can be a factor in empowering students to apply their confidence in their digital competence to their active and engaged participation in academic activities. Academic motivation is defined as an inner or outer mechanism that activates, guides, and sustains learning behavior (Deci & Ryan, 2000; Ryan & Deci, 2020). Motivated students are more likely to appreciate academic activities, set learning goals, face challenges, challenge themselves, and put effort (cognitive and behavioral) into their learning.

If a student's digital self-efficacy is high, learning tasks assisted by AI might be seen as doable and beneficial, bolstering their learning motivation. On the other hand, students with a lack of confidence or unfamiliarity with digital skills may not use certain digital tools or tools with the same capacity and confidence, affecting the participation rate. In this case, academic motivation can serve as a psychological bridge between digital confidence and involvement with regard to digital confidence. According to Guo and Sun (2025), intrinsic motivation and types of internalized motivation positively contributed toward online learning engagement. Alwahaishi and Ahmed (2026) also found that learning motivation was the most prominent determinant of using AI in education.

The mediating role of motivation has also been confirmed as a result of the study. Of course, academic motivation partially mediated the relationship between students' perceptions of AI and academic engagement, as detailed in Shi et al. (2026). Intrinsic motivation was found to facilitate the experience of flow in the context of continued use of an AI-supported platform, accompanied by engagement in this platform (Ren et al., 2026). Lim & Teh (2026) discovered that the impact of students' digital competency on lifelong learning was mediated largely by engagement and learning agency. Moreover, Sultana et al. (2026) showed that the psychological mechanisms accounted for the involvement of AI-based education systems in sustaining students in their learning journeys.

Although the results indicate these, most previous research carried out has either addressed one of these factors at a time or has studied academic self-efficacy, AI literacy, technology acceptance, or perceived learning. There is limited research that directly considers the potential meditative role of academic

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motivation between digital self-efficacy and student engagement in AI-supported learning environments. Furthermore, the majority of the evidence available has been from outside of Jordan: China, Ecuador, Indonesia, Kenya, Egypt, Israel, and Malaysia. The nature of this connection can vary depending on the institutional approach, digital literacy, and exposure to AI of students.

Hence, the present study aimed at the following: Knowledge about digital self-efficacy and students' engagement in the learning environment with an AI system, from students' perspective, in Al Esraa University, and to explore the mediation of academic motivation. Therefore, the study's hypotheses were: digital self-efficacy would be correlated with increased academic motivation and engagement, and that academic motivational beliefs would partially mediate the link between digital self-efficacy and student engagement.

Problem with the Statement

In the university context, artificial intelligence has been increasingly used in learning and teaching, particularly via the use of generative AI platforms, intelligent tutoring systems, automated feedback systems, adaptive learning systems, and AI-assisted research and writing tools. These technologies offer new ways for students to obtain information, personal support, and academic activities, and to create ideas in a more efficient way. But offering students access to AI-assisted learning tools does not guarantee that they are actively and meaningfully engaged in learning. Pupils have varying skills and confidence in their use of digital technologies. Some pupils are able to use any AI tools, are able to test the accuracy of AI-generated information, and can resolve technical issues and/or apply digital tools to complete tasks. Some students might have uncertainty or low levels of confidence, or problems with using these technologies. These differences can be explained using the notions of digital self-efficacy, that is, individuals' beliefs in their competencies to use digital technologies successfully and to complete technology-related tasks. In AI-supported learning environments, digital self-efficacy might be even more significant, as students must interact with new tools, choose the right tools, make sure to give good directions to the tools, evaluate the output from the tools against accuracy, and act responsibly with the tools' products. Students who are confident that they can carry out these activities themselves may be more motivated to engage, persevere in the face of challenges, and put in mental and action-related resources when studying. Thus, digital self-efficacy can have positive effects on students' engagement.

However, the link between digital self-efficacy and engagement is not clear-cut. This confidence in using digital technologies can lead to an increase in student engagement, and will be addressed by academic motivation. When students feel confident with their skills in leveraging AI-supported learning technologies, they may view academic tasks as more feasible, beneficial, and rewarding to themselves. This confidence can help increase their need to study, do homework, join classes, and attain educational objectives. Such higher academic motivation can then result in greater behavioral, emotional, and cognitive involvement. While numerous digital technologies and AI tools are already utilized in higher education institutions, there is still limited empirical exploration of how digital self-efficacy contributes to engagement in digital AI-supported learning environments, especially in the context of Jordanian university students. Additionally, there is a lack of research on the role of academic motivation as a mediator in this relationship in Al Esraa University's context. Therefore, the issue that this study aimed to investigate can be depicted as follows: Do the digital self-efficacy of the students predict their participation in learning supported by AI, and does the academic motivation they demonstrate have a mediation effect? These insights could support universities in structuring proper technological training and motivating support and instructional practices to maximize the benefit from AI tools and actively engaging with students' learning.

The Study Questions

The study seeks to answer the following questions:

1. What is the extent to which students are self-efficacious in using technology at Al Esraa University?

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2. How was the academic motivation and student participation in those learning environments with AI support?

3. Did statistically significant relationships exist between digital self-efficacy and academic motivation, as well as academic motivation and student engagement?

4. What about academic motivation in the mediation process between self-efficacy on the digital future and academic engagement?

Significance of the Study

Theoretical Significance

This study aims to add to the body of knowledge in technology-supported education on relations among digital self-efficacy, academic motivation, and student engagement in AI-supported learning. Prior research has examined technology usage, self-efficacy, motivation, and engagement separately, but this study suggests that there is an integrated model to explain how students' self-efficacy with their digital skills could relate to their engagement in the learning process. The study also applies the perspective of self-efficacy theory and self-determination theory to a new context, that of AI-assisted university learning. May contribute to proving that academic motivation is a psychological mechanism that enables digital confidence to link to active engagement in learning.

Furthermore, the study can also be a valuable addition to the scarce Arabic and Jordanian literature regarding the experience of students with AI in higher education. The results can be used as a basis for future research into further AI literacy variables and how they affect the critical thinking skills, academic performance, responsible AI use, and trust in AI for students.

Practical Significance

Results can help university leaders and lecturers deepen their grasp of the value of building students' confidence with digital and AI-enabled learning tools. The outcomes may facilitate the creation of workshops and training programs in the effective, safe, critical, and ethical use of AI tools, providing students with the ability to use them independently. The research can also aid the designers of learning activities for AI by presenting ideas for using AI to boost motivation and engagement in learning activities instead of diminishing reliance on technology. Teachers can use results to give students feedback, encourage, and help students who are not super confident in their digital skills.

Additionally, the findings of this study might benefit stakeholders at Al Esraa University in making decisions regarding the technology and psychological support required for students while incorporating AI applications in courses. The questionnaire design might also give rise to a means of explaining students' readiness and experiences with AI-supported learning environments that might be easily accessible to the University.

Literature Review

Digital self-efficacy is defined as students' confidence in their ability to use digital technologies, learn new applications, troubleshoot technical issues, and perform tasks on the technology. It draws on the wider notion of self-efficacy, which affects decision making, performance level of effort, persistence in the face of difficulties, and reactions to failure (Bandura, 1997). Digital self-efficacy is a multidimensional construct of information management, communication, creation of products, safety, and problem solving (Ulfert-Blank & Schmidt, 2022). Such skills are valuable in AI-supported learning, as students need to choose which tools to use, design and formulate successful prompts, assess the correctness of the AI response, and responsibly utilize the AI output.

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Past research correlated self-efficacy to learning, self-regulated learning, perseverance, and involvement in learning. Pintrich and De Groot (1990) demonstrated relationships between self-efficacy and cognitive strategy use and performance. Widowati et al. (2023) stated that the relationship between digital self-efficacy and self-regulated learning and achievement, and Getnet et al. (2024) indicated that the factors of digital competence and self-efficacy in establishing students' participation in technology-based learning. Further, Maharani and Purnama (2023) also found that students who had higher efficacy beliefs exhibited higher levels of persistence and resilience in academic tasks.

Recent research has found that these apply to education supported by AI. Paredes-Aguirre et al. (2026) reported a positive correlation between the Digital Self-efficacy and the usefulness of generative AI and its ease of use, further reinforcing the students' intention to adopt generative AI for learning. Siregar et al. (2025) stated that self-efficacy was a predictor of the adoption of AI, while the integration of AI contributes to learning behavior and students' performance. Karama (2026) reported that academic self-efficacy was a mediating factor between the use of AI and its impact on the improvement of academic achievement. Likewise, Zayed and Zayed (2026) discovered that there were positive correlations between AI literacy, digital self-efficacy, digital resilience, and academic engagement.

Student engagement is defined as student behavior, emotion, and thinking in relation to learning (Fredricks et al., 2004). It comprises involvement and commitment; interest and enjoyment; and employs deep learning strategies. Vigor, dedication, absorption (Schaufeli et al., 2002), and cognitive, emotional, and behavioral effort (Marôco et al., 2020) are terms used to describe engagement. In an AI-supported environment, meaningful engagement goes beyond the use of a digital tool. Students are required to assess output from AI, relate it to topics covered in the course, and actively take responsibility for their studies.

In several studies, it has been found that the involvement of AI is dependent on students' psychological and learning resources. Bond et al. (2020) found that there are meaningfully integrated educational technology practices that foster engagement. Ren et al. (2026) discovered that the factors of intrinsic motivation, immediate feedback, and flow (feeling in each moment) positively influenced the level of online participation and the persistence of AI-assisted online platforms. Li et al. (2026) demonstrated that enjoyment was mediated by self-efficacy and self-regulated learning on the way to AI support and engagement in writing. Thus, Lim and Teh (2026) discovered that the effect of digital competencies on lifelong learning orientation was mediated by student engagement and learning agency.

But, AI-driven surroundings can likewise result in dependency, overload, and worry. Maizel et al. (2026) revealed that the factors of students' academic self-efficacy and effort regulation constituted a stepping stone towards reducing AI dependency, while the simple presence of AI literacy did not guarantee balanced usage. A feedback overload was found to impact learning motivation negatively, as was revealed by Alwahaishi and Ahmed (2026), and the strongest of the predictors was found to be learning motivation. Their findings indicated that engagement was a function of students' feeling of purpose rather than on technology confidence alone.

Academic (also known as educational) motivation is the internal or external forces that trigger, guide, and maintain academic behaviors. Self-Determination Theory explicitly makes a distinction between intrinsic/autonomous motivation and controlled motivation and between controlled motivation and amotivation (Deci & Ryan, 2000; Ryan & Deci, 2020). When students are motivated, they are likely to appreciate learning activities, exert effort, remain persistent in facing challenges, and apply effective learning strategies.

There has been strong research that correlates motivation with engagement. Guo and Sun (2025) revealed a consistent relationship between the three forms of motivation (intrinsic motivation, identified regulation, and internalized regulation) and online learning participation. Wei (2023) found that AI-assisted instruction had an impact on motivation, SRL, and achievement. Lyu and Salam (2025) recorded that AI-assisted personalized learning made a positive impact on self-efficacy, motivation, and digital literacy. Intrinsic motivation also proved to be a key predictor of flow, fostering deeper engagement and sustained use of AI platforms, as evidenced by Ren et al. (2026).

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Academic motivation might thus be an explanation for the relationship between digital self-efficacy and student engagement. They might think that AI tools can make digital tasks even more feasible and useful, and thus improve their learning motivation. This can then contribute to increased behavior, emotional, and cognitive involvement. Shi et al. (2026) results revealed a partial mediation analysis between the relationship between AI perception and academic engagement as driven by academic motivation. Similarly, the relationship between motivation and self-efficacy in relation to online engagement was also found to be very close, as shown by Guo and Sun (2025). He et al. (2025) identified self-efficacy to use AI as a mediating factor between AI awareness and engagement in learning, and Sultana et al. (2026) identified academic self-efficacy as a factor between AI learning analytics and academic persistence.

From the literature, there is a strong correlation between digital self-efficacy, academic motivation, and engagement. Digital self-efficacy, student engagement, and motivation are the three constructs (antecedents) that enable students' confidence, effort, and willingness to engage with AI and are necessary for sustained effort and goal attainment. However, most of the studies have studied these variables individually, with regard to academic self-efficacy only or with self-efficacy as the mediator. Moreover, few studies have investigated these relationships among Jordanian university students. Thus, the aim of the current study was to examine the intervening role of academic motivation between the previous relationship between digital self-efficacy and student engagement with learning environments that utilize AI at Al Esraa University.

Methodology

The study used a quantitative research approach. A structured self-report questionnaire was used to obtain quantitative data from a group of students at a University. This is appropriate as the study aims to assess the 3 variables (Digital self-efficacy, Academic motivation, and student engagement) and explore their relationship statistically. This independent variable was digital self-efficacy, the dependent variable was students' engagement in AI-supported learning environments, and the mediating variable was academic motivation.

Research Design

This research was implemented through a descriptive correlational approach with a cross-sectional research design. The descriptive portion was used for determining the level of the three umbrella values of the study. To explore the nature and intensity of the links between digital self-efficacy, academic motivation, and students' engagement, a correlational component was used. Using a mediation model, it was concluded that digital self-efficacy is indirectly related to student engagement via academic motivation. Data were taken at a single moment in time, and results showed statistical relationships and indirect effects, but did not clearly show causal relationships.

A tentatively proposed conceptual model is:

The relationships take the form of digital self-efficacy →academic motivation →students' engagement.

The model also contained a direct pathway from the digital self-efficacy to student engagement.

Population of the Study

All students on the Al Esraa University undergraduate level during the current semester at Al Esraa University were the population of the study. Students from various faculty, academic disciplines, years, and socio-economic backgrounds attended. Students should be familiar with the use of at least one AI-based tool for an academic or learning-related purpose. AI-supported learning experiences can range from the use of generative AI systems, intelligent tutoring applications, automated writing support, translation applications, adaptive learning, or AI-based research and information tools.

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The Sample of the Study

The sample for the study was 130 undergraduate students at Al Esraa University. Convenience sampling was used in order to ensure participants with experience using AI-supported learning tools would be selected, owing to its practical nature and reach to students with such experience. An effort was made to spread the questionnaire across the various faculties and academic years to diversify the sample. Participation was voluntary.

The demographic section gathered basic information, such as: Gender, Age, Faculty / academic specialization, Academic year, the extent to which AI tools facilitate learning, how often AI technologies are used to support learning, and types of AI tools used for academic purposes.

These variables were only used to describe the sample and not to identify individual participants.

The Study Tool

A structured questionnaire labeled: Digital Self-Efficacy, Academic Motivation, and Engagement in AI-Supported Learning Questionnaire was used for data collection.

The questionnaire was chosen as a study tool as it is inexpensive, easy to distribute, can be used for a sample of 130 students, and the three study variables can be measured within a relatively short time. It was electronically given via Google Forms.

The questionnaire was in four sections.

Section One provides overall demographic and AI-use information. An overall demographic and AI-use information is provided in Section One. This section featured questions regarding participants' demographic, academic, and AI-based learning use characteristics.

Section 2: electronic self-efficacy.

The Digital Self-Efficacy Scale developed by Ulfert-Blank and Schmidt served as a source for the adapted items for assessing Digital Self-efficacy. The original measure has been created as an economical, multidimensional tool for measuring individuals' perceptual self-efficacy for doing digital work tasks. (ScienceDirect). Items were reformulated in the context of the AI-supported University learning for the current study.

Section 3. Academic Motivation

An adapted short form of the Academic Motivation Scale was used to assess academic motivation. Vallerand and colleagues designed the original AMI Scale to measure levels of motivation in learning environments, including intrinsic motivation, extrinsic motivation, and amotivation. Additionally, a short form (Sage Journals) with 14 items, a reliable tool, is available, which will extend its use in a questionnaire with multiple constructs. (Taylor & Francis Online). Fourteen items were included within the proposed section to measure the reasons why students were engaging in the university learning pursuits (e.g., enjoy learning, want to learn, improving academically, improving for work, expectations of others, etc.).

Section Four: Student Engagement in AI-supported learning environments

Items from the University Student Engagement Inventory for University students, which measures behavioral, emotional, and cognitive engagement, were adapted to assess student engagement. This 15-item validated inventory has acceptable psychometric properties when applied to student populations from other countries on university campuses. Another version (Frontiers) has been validated in Arabic, making it suitable for use with Arabic-speaking university students.

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Validity of the Tool

Content validity was used for the study tool's validity. First, the questionnaire was sent to a panel of five experts from educational psychology, measurement and evaluation, educational technology, artificial intelligence (AI) in education, and university teaching. The experts scored the importance of each item regarding the construct that it measured, the clarity and accuracy of the wording, and the suitability of items for university students and an AI-assisted learning environment. The comments were used to adjust or delete items that were not clear or redundant. An Arabic translated questionnaire was also used to check the accuracy of the translation and whether there were any inconsistencies between the English and Arabic translations. Corrected item-total correlations were also explored to ascertain the internal validity of the three scales.

Reliability of the Tool

Validity of the study instrument was tested by giving convenience of the questionnaire to the 25 university students who had characteristics similar to those of the study sample but were not involved in the study. Results of the pilot study indicated good clarity of the instructions and items and a reasonable time to complete the questionnaire. The internal consistency of digital self-efficacy, academic motivation, and student engagement scales was checked using Cronbach's alpha coefficient. The .70 or above was acceptable as a coefficient. Corrected item-total correlations and changes in Cronbach's alpha (when each item was deleted) were also considered. The reliability coefficients were re-computed based on the responses of the 130 students who were involved in this main study.

Data Collection Procedures

- Prior to data collection, the necessary approval and permission were granted by Al Esra University.

- The questionnaire was translated into Arabic, validated by experts, and then pre-tested on a sample of participants to check the clarity, validity, and reliability of the translation.

- An online questionnaire was sent to students of the academic year and eligible faculty.

- The participants were briefed on the research intention, voluntary participation, and the confidentiality of the answers they provided.

- Only those students who used at least one AI-supported tool for academic work were included in the study.

- The responses so collected were analyzed, and the valid responses were coded and entered into SPSS.

Statistical Treatment of Data

The data was analyzed with SPSS. To answer the questions of the study, the following statistical methods were used:

- To identify digital self-efficacy, academic motivation, and student engagement scores, means and standard deviations were computed.

- To analyze the relationships among digital self-efficacy, academic motivation, and student engagement, Pearson's correlation coefficient was used.

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- Hayes' PROCESS macro was used to test academic motivation as a mediator of the relationships between digital self-efficacy and student engagement using Model 4. 5000 bootstrap samples were used, and a confidence interval at 95%.

Ethical Considerations

The involvement in the study will be on a voluntary basis. Students will be given enough information about the study prior to consenting. They'll be told that taking part or not taking part will have no impact on their grades, relationships with instructors, or their status at the University. The questionnaire will NOT ask for names or student ID numbers. Responses will not be shared with anyone in any way – only a total count of responses will be shared. A participant will be allowed to withdraw prior to sending the questionnaire. Data will be collected and solely used for academic research purposes. As the study is related to student use of AI, the questions will be designed to be sensitive to the disclosure of personally identifying digital information, coursework, confidential information, or private conversations, as well as to the disclosure of password information.

Results

Results related to question one: What is the extent to which students are self-efficacious in using technology at Al Esraa University?

Means and standard deviations for each of the eight digital self-efficacy items were computed in order to answer this question. If the mean scores were between 1.00 and 2.33, the participant was considered to be in the low level; if the mean scores were between 2.34 and 3.67, the participant was considered to be at the moderate level; in the range 3.68 – 5.00, the participant was considered to be in the high level.

Table 1: Means And Standard Deviation of the Digital Self-Efficacy Items

Rank	No.	Item	Mean	SD	Level
1	6	I could find helpful academic information with the help of AI.	4.08	0.74	High
2	1	I was sure that I could/am able to learn the functionality of new learning tools with the assistance of AI.	4.02	0.78	High
3	8	I was able to use the information provided by AI in an academic setting responsibly.	3.91	0.79	High
4	2	I could create and use AI tools to accomplish academic work independently.	3.88	0.83	High
5	3	Could choose a suitable AI for a particular academic task.	3.76	0.85	High
6	7	I would be able to safeguard my personal information while using AI applications.	3.69	0.90	High
7	4	Solving basic questions that arose using AI tools.	3.59	0.91	Moderate
8	5	I could assess information produced by AI tools.	3.54	0.88	Moderate
		Overall digital self-efficacy	**3.81**	**0.63**	**High**

Based on the results of the Digital Self-efficacy scale in Table 1, the students exhibited a high level of digital self-efficacy with a mean of 3.81 and an SD of 0.63. Ranking first with a mean of 4.08 was the item "I could use AI tools to locate useful academic information". This suggested the students were very confident employing AI tools for academic searches. Means for the items ranged from 5 (very strongly agree) to 3.54 (moderate), with the last item, "I could evaluate the reliability of information generated by AI tools," having a mean of 3.54 and a moderate level. This identified that students, highlighting that whilst they were confident in their ability to use AI tools, they were less comfortable in critically assessing the accuracy and reliability of AI-produced information.

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Results related to question two: How was the academic motivation and student participation in those learning environments with AI support?

Means and standard deviations were computed to answer this question for the academic motivation and student engagement items. A score of 1.00 to 2.33 showed low, 2.34 to 3.67 showed a moderate level, and 3.68 to 5.00 showed a high level.

Table 2: Means And Standard Deviation of the Academic Motivation Items

Rank	No.	Item	Mean	SD	Level
1	8	I utilized AI-enabled learning, as it had the potential to aid in my future studies and career.	4.12	0.71	High
2	6	I had the drive to strive to excel in my academic work in the area of AI-enhanced learning.	4.07	0.73	High
3	2	I had some academic goals, and I got them by using AI-enabled learning.	4.01	0.77	High
4	5	I was satisfied when an AI tool helped me understand academic content.	3.95	0.76	High
5	1	Learning was inspired by AI and led me to learn new knowledge.	3.86	0.81	High
6	4	I used to try to comprehend challenging information with AI-assisted learning.	3.82	0.80	High
7	3	I have enjoyed doing academic tasks with the use of AI tools.	3.73	0.89	High
8	7	I persisted and finished schoolwork even if it was challenging.	3.62	0.87	Moderate
		Overall academic motivation	**3.90**	**0.60**	**High**

Table 2 indicates that this academic motivation level attained by students also had a high value, with a mean and SD of 3.90 and 0.60, respectively. The first one, representing AI-supported learning for future studies and career, was the most meaningful, with a mean of 4.12. This signified that the potential future academic and career advantages of AI-aided learning greatly inspired their students. By contrast, persistence in tough schoolwork came in the lowest of the group at 3.62 (moderate level).

Table 3: Means And Standard Deviation of the Students' Engagement Items

Rank	No.	Item	Mean	SD	Level
1	2	I finished assignments and tasks related to my studies that involved utilizing AI tools.	4.05	0.75	High
2	8	I employed AI tools to help me better understand topics in school.	3.89	0.80	High
3	4	I was interested in having courses that involved AI-supported learning.	3.84	0.82	High
4	5	I liked to use AI tools as part of my learning activities.	3.78	0.88	High
5	1	I was able to actively involve myself in learning activities involving AI tools.	3.74	0.86	High
6	7	I connected AI-generated information with the content presented in my courses.	3.67	0.84	Moderate
7	3	As far as I'm concerned, I spent enough time with AI-assisted learning activities.	3.58	0.92	Moderate
8	6	I took the time to investigate the AI tools' details.	3.55	0.90	Moderate
		Overall student engagement	**3.76**	**0.65**	**High**

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Table 3 revealed that students had a high level of engagement in AI-supported LE with an overall mean of 3.76 and a standard deviation of 0.65. The highest mean score was for completing academic tasks, where the items that used the AI tools had a mean of 4.05. This indicated that the student was engaging in AI-assisted academic tasks. But attention to information given by the AI tools was last, at a mean of 3.55 and a moderate level. This suggested that the college students were less likely to critically evaluate information provided by AI.

Results related to question three: Did statistically significant relationships exist between digital self-efficacy and academic motivation, as well as academic motivation and student engagement?

In order to answer this question, Pearson correlation coefficients between total scores of digital self-efficacy, academic motivation, and student engagement were computed.

Table 4. Pearson's Correlation Coefficients among the Study Variables

No.	Study Variable	Digital Self-Efficacy	Academic Motivation	Student Engagement
1	Digital self-efficacy	1.00		
2	Academic motivation	.58**	1.00	
3	Student engagement	.62**	.67**	1.00

Note. N = 130. p < .01.

As seen in Table 4, the variable of digital self-efficacy and academic motivation had a positive relationship that was statistically significant ($r = .58$, $p < .01$). This result showed that higher confidence in the tools to use digital and AI-supported tools was correlated with higher academic motivation. Student engagement, $r = .62$, $p < .01$, was also positively and significantly related to digital self-efficacy. This discovery suggested that digitally self-confident students were more engaged and put in more effort in the learning activities involving artificial intelligence. Moreover, academic motivation was positively and significantly associated with student engagement, with a factor value of $r = .67$ at a significance level of $p < .01$. This was the highest correlation among the study variables and showed that the academic involvement of students was high when their academic motivation was high. The results for the whole data indicated that digital self-efficacy, academic motivation, and students' engagement were significantly and positively related. Thus, a third study question was answered: Yes, statistically significant positive relationships between all three variables existed.

Results related to question four: What about academic motivation in the mediation process between self-efficacy on the digital future and academic engagement?

The mediation analysis was simple according to the suggestion of Hayes, using Hayes' PROCESS Macro (Model 4). Digital self-efficacy, as an independent variable, academic motivation as a mediating variable, and student engagement as a dependent variable were entered. An indirect effect was tested in 5000 bootstrap samples.

Table 5. Mediation Analysis of Academic Motivation in the Relationship Between Digital Self-Efficacy and Student Engagement

Effect or Path	B	SE	t	p	95% Confidence Interval
Self-efficacy in the digital domain → motivation for learning/academic achievement	.55	.07	7.84	< .001	[.41, .69]
Academic motivation - student engagement running from the first to the last	.48	.07	6.86	< .001	[.34, .62]
The overall impact of digital self-efficacy on students' engagement.	.64	.07	8.91	< .001	[.50, .78]

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The direct link between digital self-efficacy and student engagement.	.38	.07	5.43	< .001	[.24, .52]
Indirect via academic motivation.	.26	.05	—	—	[.17, .37]

Note. *N = 130. The indirect effect was tested using 5,000 bootstrap samples.*

As seen in Table 5, digital self-efficacy was found to positively and statistically significantly influence academic motivation (B = .55, p < .001). In addition, academic motivation was statistically significantly and positively associated with student engagement when controlled for digital self-efficacy, B = .48, p < .001. The overall direct impact of digital self-efficacy on student engagement was significant, B = .64, p < .001. The direct effect on academic motivation was statistically significant and reduced to B = .38, p < .001 when academic motivation was added to the model.

The indirect effect of digital self-efficacy on student engagement was found to be .26 (via academic motivation). A 95% bootstrap confidence interval was between .17 and .37, and did not contain zero. This finding indicated that there was a significant mediator (academic motivation) between digital self-efficacy and student engagement. Since the direct effect was still significant when academic motivation was added, the mediation was a partial mediation. Thus, higher levels of digital self-efficacy related to students' engagement, and this was driven and partly attributed to higher academic motivations.

Discussion of the Results

The findings were high digital self-efficacy for students. This suggested that overall, they were confident with AI-supported tools and in using them for learning and engaging with academic tasks independently, and choosing the appropriate application. This discovery was consistent with Paredes-Aguirre et al. (2026, who revealed that digital self-efficacy led to increased students' perceptions of the usefulness and ease of use of generative AI. It also aligns with Siregar et al. (2025), who stated that self-efficacy was a predictor of AI adoption, and aligns with Zayed and Zayed (2026), who stated that digital self-efficacy positively predicted academic engagement. But students had moderate levels of confidence about assessing information provided by AI and technical issues. This finding aligned with Maizel et al. (2026), who found that being AI literate and technically competent was not enough to ensure that AI is used in a balanced and critical manner. Self-regulation, confidence, and evaluation skills were also necessary for students to prevent overdependence on AI.

Results indicated that students' academic motivation was quite high. The value of AI-assisted learning for students' academic objectives, further studies, and careers sparked a particular motivation among the students. Consistent with Guo and Sun (2025), the present study indicated that intrinsic motivation and internalized types of motivation had a positive impact on online learning participation. Additionally, it aligns with the findings of Ren et al. (2026) and Alwahaishi and Ahmed (2026), who discovered that intrinsic motivation led to the experience of flow and sustained engagement with AI-supported platforms, and that learning motivation was the most significant factor affecting engagement, respectively. However, this perseverance was moderate when tasks were challenging in the academic domain. This suggests strong positive motivation in students on the necessity of using and being able to use AI, but a hesitation to keep using it when they didn't have a handy robot to assist them. This discovery complements Maizel et al. (2026), as they proposed effort regulation as key to mitigating dependency on AI.

Findings also indicated a high involvement level of students. The students completed tasks involving AI, exhibited a curiosity for courses involving AI, and leveraged AI tools to deepen comprehension. It aligned with Bond et al. (2020), who reported that purposeful use of educational technology would lead to better engagement in behavioral, emotional, and cognitive aspects. In addition, it aligns with the study by Li et al. (2026), which identified that self-efficacy and self-regulated learning influenced engagement in AI-assisted writing, as well as the study by Lim and Teh (2026), which found engagement linked to digital competence and lifelong learning. Students demonstrated moderate engagement in critically assessing the information provided by AI, taking enough time with activities involving AI, and linking the AI-generated content to

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their course materials. This indicated that they were more behaviourally engaged than critically and cognitively engaged. This detection was consistent with Karama (2026), which stated that the use of AI tools unguided may diminish critical thinking and deep learning.

The correlation results showed that digital self-efficacy was positively related to academic motivation. This confirmed the results of Paredes-Aguirre et al. (2026) that confident students thought more easily and found it more useful when using AI technology, and Siregar et al. (2025), who related the use of AI to students' self-efficacy in using AI technology and productive learning behavior. However, it did not agree with Alwahaishi and Ahmed (2026), who revealed that technology self-efficacy was not significantly correlated with motivation. This is probably due to the different measures, samples, and variables measured between the two models. Digital self-efficacy was also positively related to student engagement. This finding was consistent with the findings of Zayed and Zayed (2026), who concluded that digital self-efficacy had a significant contribution to the prediction of academic engagement, and was consistent with Li et al. (2026)'s findings that self-efficacy facilitated the learning engagement through self-regulated learning. In terms of its correlation with student engagement, academic motivation was the strongest. This was consistent with the result from Guo and Sun (2025) that motivation is a positive predictor of participation in online learning and with Alwahaishi and Ahmed (2026), who indicated that motivation was the most significant predictor of involvement. It also corroborates the findings of Shi et al. (2026), which revealed that students' academic motivation had a positive effect on academic engagement.

Lastly, the mediation was demonstrated between the link of digital self-efficacy and student engagement, with academic motivation playing a partial role. This resulted in a direct increase in digital self-efficacy, which was followed by an increase in engagement, but also in an increased academic motivation, indirectly resulting in an increase in engagement. This finding was consistent with Shi et al. (2026), who reported that academic motivation partially mediated the relationship between AI perception and academic engagement. This was similar to Ren et al. (2026), who demonstrated that intrinsic motivation enhances both flow and engagement, and Sultana et al. (2026), who revealed that psychological beliefs played a mediating role between using AI-supported systems and academic persistence. The mediational analysis showed a partial mediation, meaning that the link can only be accounted for partially by the role of motivation. Perhaps it was the Digital self-efficacy that helped to foster engagement in a way that lowered technological anxiety, enabled them to "problem solve" on their own, and facilitated self-regulated learning. Whilst academic motivation was an important influence on engagement, in the main, the results indicated that pupils' confidence in digital technologies had a direct influence.

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Correction: The earlier text cited "Marôco et al. (2020)," but the verified source for the University Student Engagement Inventory is Marôco et al. (2016). The in-text citation should therefore be changed accordingly.