

The Role of AI Literacy in Reducing Academic Anxiety and Enhancing Self-Regulated Learning Among University Students

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Abstract

This study aimed to investigate how artificial intelligence (AI) literacy can alleviate academic anxiety and facilitate self-regulated learning among students at universities. The study was of a descriptive correlational type; the study sample included 80 undergraduate students in Al Esra University who had utilized artificial intelligence tools as learning media, and the study covered students who had used the artificial intelligence tools for academic purposes. Data was gathered with a questionnaire that included measuring the AI literacy, academic anxiety, and self-regulated learning. Data were analyzed by means, standard deviations, and Pearson's correlation coefficients. Pearson's correlation coefficient was employed for data analysis. The results indicated that the AI literacy and self-regulated learning level among students are high, and the academic anxiety level is moderate. The result showed that there was a negative relationship between AI literacy and academic anxiety, which is statistically significant, meaning the respondents with higher AI literacy experienced lower academic anxiety. The results showed that there was a statistically significant positive relationship between AI literacy and self-regulated learning, and that artificially intelligent literacy at a high level means that students have good goal setting, planning, monitoring, strategy use, and self-evaluation. The data in this study indicate that AI literacy is a significant psychological and educational resource that can contribute to student confidence and independence in doing academic tasks supported by AI. The research proposes that training university students should be given in effective prompting, critical evaluation of AIG information, promoting an ethical framework for AI usage, and fostering autonomous approaches or strategies for utilizing AIG information.

Keywords: AI Literacy, Academic Anxiety, Self-Regulated Learning, University Students, Artificial Intelligence.

Introduction

AI is playing a significant role in the world of higher education, transforming students' access to information, feedback, assignment completion, and learning facilitation. AI-enabled technologies such as generative AI, intelligent tutoring systems, adaptive platforms, automatic assessments, and conversation agents can personalize learning, pinpoint students' strengths and weaknesses, and offer timely and targeted support for learning (Chen et al., 2020; Chiu et al., 2023; Karaoglan Yilmaz & Yilmaz, 2024; Porter & Grippa, 2020). Beyond these benefits, Generative AI has the potential to enhance writing, idea generation, grammar, and fluency, and decrease the time spent finalizing academic work (Chen, 2023; Lund & Wang, 2023; Salvagno et al., 2023).

But accessing AI does not necessarily lead to good learning. The growing use of AI requires students to be knowledgeable about the capabilities and limitations of AI, how to write effective prompts, how to evaluate information generated, how to identify bias, privacy, and ethical concerns, and how to use AI in an ethical manner (Long & Magerko, 2020; Wang et al., 2023). Students' lack of these skills can lead them to accept incorrect information, to use more cues from prepared answers than necessary, or to turn to technology to do the thinking for them. This dependence can affect the autonomy, creativity, critical thinking, and problem-solving abilities (Bulathwela et al., 2024; Klingbeil et al., 2024; Nyaaba et al., 2024; Zhai et al., 2024).

This speedy advancement of AI has also rendered mental obstacles. Students might have anxiety regarding the inaccuracy of outputs, privacy, academic integrity, technological complexity, and employment prospects after graduation (Almaiah et al., 2022; Ijaz & Ishaq, 2024; Wang et al., 2024). Excessive reliance and avoidance of, and low confidence in, AI can result from high anxiety and interfere with cognitive resources, concentration, confidence, and avoidance of using AI (Upadhyaya & Vrinda, 2021; Wang et al., 2020).

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Batool et al. (2024) concluded that there was an inverse relationship between AI anxiety and self-efficacy and academic performance. In addition, Wu et al. (2024) demonstrated that AI anxiety led to AI dependence, and it was mostly due to the reduction in students' levels of confidence to design and use AI effectively.

By increasing the understanding and manageability of AI systems, AI literacy can help decrease anxiety. Learners who are aware of the limitations of AI and understand how to check the answers given by AI might feel more control and less uncertainty. It has been found in the literature that low levels of digital competence and self-regulation are connected with low levels of AI anxiety, and that low AI literacy is related to blind dependence (Karaoglan Yilmaz et al., 2024; Liu, 2024). However, it is important to combine practical skills and emotional counseling with literacy, as literacy alone might not alleviate anxiety that pushes people toward reliance (Wu et al., 2024).

The development of AI literacy could also benefit self-regulated learning, a process that includes setting goals, planning, using strategies, managing time, monitoring, regulating effort, and evaluating themselves (Pintrich, 2000; Zimmerman, 1989, 2013). AI can help these processes with individualized feedback, study planning, practicing, and monitoring progress. Having knowledge about AI has been correlated with increased planning and learning regulation (Chan & Hu, 2023; Xie, 2023), and AI-assisted teaching with increased motivation and SRL (Wei, 2023). Shi et al. (2024) showed that AI literacy and SRL positively affected the writing performance, while Thiangtham et al. (2024) found that AI literacy had a strong positive impact on SRL, self-efficacy, and autonomous learning. Liu (2024) also indicated that self-regulated learning decreased the level of reliance on AI.

In spite of such evidence, few investigated studies have studied the three constructs of AI literacy, academic anxiety, and SRL simultaneously, especially in the context of Jordanian university students. Based on the above, this study focused on the association between AI literacy and the reduction of academic anxiety and enhancement of self-regulated learning among the students of Al Esra University.

Problem Statement

University students are utilizing tools of Artificial Intelligence to search for information, comprehend academic content, complete assignments, translate materials, generate ideas, get feedback, and organize learning activities. While these tools are widely available, students' critical, effective, and responsible use of AI varies. Some students are aware of the limitations of AI, fact-check what it generates, are aware of what may be missing, privacy, and regulations about using it in accordance with academic-integrity rules. Other students might have these capabilities and use information from AI without doing adequate assessment. They can also find themselves lost as to how to use AI or whether they can trust and accept AI-generated content.

All of these differences can impact students' academic anxiety if students lack understanding of the way in which AI systems function or the criteria for assessing the effectiveness of AI-generated work. There are some concerns that stem from this. As AI applications continue to evolve quickly, students could also experience a sense of not being able to keep up with technological transformations. Meanwhile, the lack of AI literacy among students can limit their ability to effectively leverage AI to facilitate self-regulated learning. It is important for students to use AI only to get an instant answer and not to set learning objectives, choose learning strategies, track their learning, organize their time, or assess their learning. This passive use could deplete, rather than enhance, students' capacities for autonomous learning. On the other hand, students with more advanced AI literacy may be more capable of strategic utilization of AI tools. They might feel less uncertain, more confident in the assessment of the information that AI has provided, adhere to ethical guidelines, and find ways to use AI to plan, monitor, and reflect on their learning. Hence, there might be a negative correlation between AI literacy and academic anxiety and a positive correlation between AI literacy and self-regulated learning.

Though such relationships are important, there is minimal empirical evidence on AI literacy, academic anxiety, and self-regulated learning of Jordanian university students. Thus, the problem that the current

study aims to solve can be formulated into the following question: What is the role of AI literacy in reducing academic anxiety and improving SRL among Al Esra University students?

Study Questions

The study aims to address the following research problems:

1. The objective of this study is to answer the question: "What is the level of student AI literacy, academic anxiety, and self-regulated learning at Al Esra University?"
2. What is the statistical relationship between AI literacy level and academic anxiety of students in Al Esra University?
3. Do students at Al Esra University have a statistically significant relationship between AI literacy and self-regulated learning?

Study Objectives

The study aims to:

1. To find out the level of AI literacy of students in Al Esra University.
2. To determine how anxious students are in learning at Al Esra University.
3. Identify the self-regulated learning level of the student at Al Esra University.
4. Analyze the correlation between AI Literacy and academic anxiety.
5. Investigate the connection between AI literacy and self-regulated learning.
6. Determine the predictive contribution of AI literacy to academic anxiety.
7. Find the predictive effect of AI literacy on self-regulated learning.

Significance of the Study

Theoretical Significance

This study could add to the literature on educational and psychological impacts of Artificial Intelligence in higher education. Although research on the use of AI, digital literacy, self-efficacy, engagement, motivation, and academic outcomes has been conducted, there is limited research on AI literacy in connection with academic anxiety and self-regulated learning. In the study, an integrated model is put forward, where AI literacy is regarded as one of the competencies in education and can have an influence on the emotions of students as well as their learning behaviors. It can help clarify the relationship between learning more about AI, critical learning appraisal abilities, cognitions of ethical knowledge and ethical use, and less academic anxiety and greater academic self-regulation. The study also can add to the scant literature focused on AI literacy in Jordanian/ Arabic universities. The results of this research study could serve as a starting point for further research into AI literacy and its effect on academic achievement, critical thinking, psychological wellness, academic integrity, AI dependence, and motivation and engagement.

Practical Significance

The results could inform the university administration of why it is essential to teach AI literacy to students, not just make AI tools available. The outcomes can be utilized by universities to create training programs to equip their students with the skills necessary to choose the right AI applications, develop effective

prompts, verify AI-generated content, identify bias, safeguard privacy, and responsibly utilize AI. The results can also help college counselors better identify students who may experience academic anxiety due to technological changes or confusion about using AI for academic work. AI-literacy workshops can be integrated into counseling and academic-support programs, helping to alleviate students' concerns and promoting feelings of control. Instructors can leverage the results to frame learning activities to have their students plan, provide feedback, reflect, and problem solve with AI, but not rely on it to copy their work or supplant independent thinking. The results can also contribute to the elaboration of guidance at AI Esra University concerning the responsible use of AI and foster suitable learning spaces that are psychologically safe when using AI.

Operational Definition

AI Literacy

AI literacy encompasses an understanding, the ability to use, evaluation, and ethical conscious interaction with AI systems in academic environments. Among the operational attributes, a score earned by a participant on the AI Literacy Scale in the present study indicates the operational attribute. A higher score is more indicative of higher AI literacy.

Academic Anxiety

Academic anxiety is a range of emotions and thoughts of worry, tension, apprehension, nervousness, and cognitive discomfort related to academic requirements, assignments, exams, academic performance expectations, and the prospect of academic failure. It is operationally defined as the overall Academic Anxiety Scale score. Acquired Academic Anxiety will be measured by a higher score.

Self-Regulated Learning

Self-regulated learning can be defined as the ability of students to set goals, plan for learning, use effective strategies, manage their resources and time, monitor learning, adjust performance, solicit help, and assess the outcome of their learning. Changes in its operational representation, namely the overall score on the Self-Regulated Learning Scale. The higher the score, the more likely it is that the student is a more self-regulated learner.

Literature Review

AI Literacy in Higher Education

With the rapid adoption of Artificial Intelligence in University education, students' proficiency in various aspects of AI has emerged as a key competence. It does not just mean how proficient one is in running AI applications but also how they understand their capacities and limitations, communicate with them, critically evaluate their outputs, and apply ethics when using them (Long & Magerko, 2020; Wang et al., 2023). AI-literate students will be able to create effective prompts and be aware of possible biases and fabricated information, check AI for accuracy, avoid exposing personal data, and know when it is acceptable to use AI in the classroom.

As people have come to recognize the ability of generative AI to assist them in academic writing, information retrieval, idea generation, receiving feedback, and personalized learning (Chen, 2023; Lund & Wang, 2023; Salvagno et al., 2023), the importance of developing AI literacy is growing. Additionally, adaptive systems and intelligent tutoring applications have been able to eliminate students' weaknesses, adapt the content of instruction, and give instant feedback (Chiu et al., 2023; Karaoglan Yilmaz & Yilmaz, 2024; Porter & Grippa, 2020). However, the learning gains rely on the capacity of the students to assess the accuracy and relevance of AI-provided results and to decide on their moral acceptability.

AI literacy is believed to be associated with a number of positive learning outcomes. According to Shi et al. (2024), AI literacy had a positive relationship with the writing accomplishment of university students as well as their well-being in the context of AI. Dang and Nguyen (2024) found that there was a weak positive correlation between AI literacy and academic performance; however, AI self-efficacy had a significantly stronger impact. According to Thiangtham et al. (2024), AI literacy significantly contributed to self-regulation, self-efficacy, and critical thinking, and it, in turn, was linked with autonomous learning. Likewise, Farmanesh et al. (2023) found that engagement and self-efficacy led to higher AI literacy and that anxiety reduction was a significant psychological pathway.

However, knowing about AI does not imply proficiency in its use. Students might have some knowledge about AI and still engage too much in the use of the AI-generated answers. Promise of cognitive offloading and automation bias are potential side effects of weak verification practices, as is reduced independent reasoning (Klingbeil et al., 2024; Zhai et al., 2024). It is likely that the use of AI can also demobilize creativity, critical thinking, and learner autonomy (Bulathwela et al., 2024; Nyaaba et al., 2024). AI literacy, as such, should involve critical evaluation, reflective judgment, and personal responsibility with regard to academic work.

Academic Anxiety in AI-Supported Learning

As AI grows, emotional and educational issues are becoming an issue. AI Anxiety is a term used to describe when an individual experiences apprehension, discomfort, or fear related to comprehending, utilizing, or adopting AI technologies. Students could have concerns about the outputs of the IAGs not being accurate, concerns about privacy, surveillance, academic dishonesty, technological replacement, or keeping up with the rapid evolution of applications (Almaiah et al., 2022; Ijaz & Ishaq, 2024; Wang et al., 2024). In addition, there may be uncertainty from the opacity of AI systems, making it hard for students to always comprehend and determine the reliability of the responses. Anxiety can have an impact on learning, concentration, self-confidence, and involvement in school. Technology burnout, reduced self-efficacy, and inappropriate use of technology have been linked to stress (Upadhyaya & Vrinda, 2021; Wang et al., 2020). In the present study, Batool et al (2024) revealed that AI anxiety was negatively correlated with self-efficacy and academic performance. Learners who had higher levels of anxiety rated themselves lower in their abilities to learn and had poorer academic results. Similarly, Wu et al. (2024) reported a positive relationship between AI anxiety and AI dependence due to a decrease in students' AI self-efficacy.

Digital competence and AI-literacy can support students in dealing with this anxiety. According to Karaoglan Yilmaz et al. (2024), there is evidence that digital competence, cognitive flexibility, and self-regulation gave a lower value of AI anxiety for students in university. Good digital competence enabled students to better understand and apply AI, and self-regulation facilitated their learning process, reducing anxiety. AI-powered learning can lessen anxiety by providing tailored explanations, engaging in private practice, delivering prompt feedback, and allowing learners the freedom of their own pacing. In the language-learning domain, students can train using LLM without the pressure of being judged negatively due to the small risk provided by LLM (Farmanesh et al., 2023). The results of the study conducted by Zafar et al. (2024) showed that the use of AI had a positive correlation with emotional regulation and a negative one with learning anxiety. Similarly, Mariano (2023) found statistically significant correlations between the use of AI, academic buoyancy, and psychological well-being.

However, the connection between AI literacy and anxiety may not be as straightforward. Wu et al. (2024) determined that mere improving AI literacy was not consistently found to be protective against anxiety-driven dependence. Leveraging increased knowledge can lead to students becoming more aware of what abilities are expected of them, as well as the limitations and ethical risks associated with AI. Therefore, lively AI-literacy education needs to go hand-in-hand with technical skill transfer, confidence boosting, emotional support, and explicit institutional guidance.

Self-Regulated Learning in AI-Supported Education

Self-regulated learning is the way in which students set goals, plan, select, monitor, apply regulating effort, and evaluate (Pintrich, 2000; Zimmerman, 1989, 2013). It demands that students take an active part in the learning they undergo and not rely fully on the instructors or the technological systems they use. AI has the ability to assist in self-regulated learning via personalized feedback, progress monitoring, reminders, adaptive tasks, and study planning. Intelligent systems can be used to give students feedback about their weak points, arrange activities, and adapt strategies based on their performance (Aleven et al., 2016). Knowing about AI has also been found to be correlated with good planning, monitoring, and regulation of learning behavior (Chan & Hu, 2023; Xie, 2023). Wei (2023) concluded that the AI-assisted learning improved self-regulated learning, motivation, and outcome of academic achievement. The study conducted by Balouch et al. (2023) indicates that there was a significant positive correlation between the use of AI and self-regulated learning. More effective students used AI to show more planning, monitoring, and reflection. Kanapathipillai et al. (2024) also found that time management skills are positively related to the academic value of the use of AI, meaning that technologies, when backed by self-regulated behaviors, have stronger results. Wang et al. (2024) also found that the effects of psychological need satisfaction on AI literacy were mediated in a direct and indirect manner through the self-regulated learning strategies.

Overall, AI literacy can enhance self-regulated learning by enabling students to choose the right tools, formulate accurate prompts, validate responses, and assess the value of AI-generated content to their learning objectives. The results of Shi et al. (2024) showed that writing performance was predicted by AI literacy and self-regulated learning, with the latter having a larger effect. Similarly, Thiangtham et al. (2024) found that self-regulation was one of the significant mechanisms by which AI literacy led to autonomous learning. Students are also shielded from overreliance on AI tools by means of self-regulation. Liu (2024) discovered that self-regulated learning had a negative predictive effect on AI dependence and indirectly weakened the effect of AI dependence through a reduction in the frequency of usage. Students who demonstrated high self-regulation abilities appeared to be more able to balance with the assistance of AI with self-study. This is evidenced by earlier studies that self-regulation helps learners be autonomous and not rely on any tools (Eckley et al., 2023, and Mirmoadi and Satwika, 2022).

On the other hand, there is a risk of "de-incentivizing" hard work by generating correct answers, or if students become too dependent on AI. Being overdependent has been linked to less creativity, less time control, and less independent thinking (Abuzaid et al., 2022; Klímová et al., 2023; Zhang et al., 2024). The educational sense of the use of AI is thus less about how much they use it and more about how they use it – strategically, critically, and reflectively.

Synthesis and Research Gap

As per reviewing literature, AI literacy might impact emotional adaptation as well as learning regulation. By learning about the abilities, limitations, and ethical considerations of AI, students will likely have more control over and feel less uncertain when utilizing this technology, thereby minimizing academic stress. They might also be more ready to take advantage of the AI to set goals, give feedback, track progress, and reflect, which all boost self-regulated learning. This doesn't just mean having knowledge, though; the successful application of artificial intelligence also entails self-efficacy, emotional support, and self-regulatory abilities. Existing research has primarily considered AI literacy in terms of achievement, engagement, well-being, self-efficacy, autonomous learning, or AI dependence. There are other studies that aimed to examine AI anxiety separately from SRL. However, there is limited research that has included analyzing the relationship between both AI literacy and academic anxiety and AI literacy and self-regulated learning in the same model, especially among Jordanian University students. Hence, this current study investigated the relationship between AI literacy and the reduction of academic anxiety and increased SRL of Al Esra University students.

Methodology

Research Design

This study used a quantitative research approach. A structured, self-report questionnaire was used to collect quantitative data. Measurement and statistically examining the relationships between the variables is suitable for the purpose of the study to measure AI literacy, academic anxiety, and SRL. The independent variable investigated was AI literacy. There were two dependent variables: academic anxiety and self-regulated learning.

Research Design

The research design employed was a descriptive correlational study, which is a study conducted by a cross-sectional approach. Descriptive use is to find the level of AI literacy, academic anxiety, and self-regulated learning of the participants. The correlational aspect of the study aimed to investigate how the relationship between AI literacy and academic anxiety and between AI literacy and self-regulated learning was directed, and the strength of these relationships. A predictive component was used to assess the predictive value of AI literacy to academic anxiety and self-regulated learning. Data were gathered at a single period of time. Thus, the results revealed statistical relationships and predictive contributions but were not necessarily causal connections.

Population of the Study

The study population comprised the undergraduate students of Al Esra University in the semester in question. Students from various faculties and specialisms, academic years, and demographic backgrounds were included in the population. Students will be eligible if they have used one of the AI-assisted tools for a learning and/or academic purpose. Potential technologies that could be considered include applications of generative AI, intelligent tutoring systems, automated writing-support technology, translation, adaptive learning, AI-supported research, and automated feedback technology.

Sample of the Study

The sample was 80 undergraduate students of Al Esra University. The study employed a convenience sampling method as it is suitable for providing access to students with experience in using AI tools for academic purposes. Every effort was made to achieve diversity in students with regard to the different faculties they were from and the different academic years they were studying in. Participation was voluntary. The study did not include students who haven't used or applied an AI source for an academic purpose.

The Study Instrument

- The data was obtained from a structured questionnaire label.
- AI Literacy, Academic Anxiety, and Self-Regulated Learning Questionnaire (AILASRLQ).
- The questionnaire was disseminated electronically using Google Forms.
- This questionnaire was divided into three sections:

Section One: AI Literacy Scale

Students' proficiency in utilizing AI tools was assessed using the AI Literacy Scale, which evaluated their understanding, use, evaluation, and ethical engagement with AI tools. The proposed scale included around 12 items within 4 dimensions:

1. Minimal understanding of the capabilities and limitations of AI.

2. Hands-on experience and engagement with AI applications.

3. Critically evaluating information created by AI.

4. Responsible and ethical use of AI.

Section Two: Academic Anxiety Scale

The academic Anxiety Scale was used to assess their concerns, stress, and anxiety about academic assignments and performance. There were around 10 items in the proposed scale.

Section Three: Self-Regulated Learning Scale

Self-regulated learning was measured via the Self-Regulated Learning Scale (SRLS), which assessed students' goal setting, planning, strategy use, time management, monitoring, effort regulation, help seeking, and self-evaluation. The total number of items for the proposed scale was about 12.

Validity of the Instrument

The instrument of this study will be tested for content validity. A total of about five experts in Educational Psychology, Measurement and Evaluation, Educational Technology, Artificial Intelligence in Education, and University Teaching will receive the initial questionnaire.

The experts evaluated:

The appropriateness of each item for the variable to which it was devised.

Clearness of the wording.

- How appropriate the products are for use within the university setting.
- The suitability of the content for learning situations with AI.
- Appropriateness of the number of items.
- Linguistic accuracy of Arabic/English version.

Perceptions of "unclear", "repetitive," and "irrelevant" were revised or deleted as per the experts' opinion. Also, corrected item-total correlations will be analyzed to assess the internal validity of each scale.

Reliability of the Instrument

A pilot study is performed with about 15-20 university students with similar characteristics to the main study, who will not be included in the actual study.

The pilot study was assessed on:

- Instructions on how to use the software.
- Ease of understanding of items.
- Time it takes to fill in the questionnaire.
- Possible technical problems with the electronic form.

- The preliminary internal consistency of the scales.

Cronbach's alpha was used and calculated for the AI Literacy, academic anxiety, and self-regulated learning scales.

Data Collection Procedures

The data collection was done after seeking the approval of Al Esra University. Expert face-to-face and pilot testing of the questionnaire was done for clarity and reliability in Arabic. It was then made available digitally to undergraduate students who have used any AI tool in any academic writing. The participants were informed of the purpose, voluntary participation, and confidentiality of the study. A total of 80 valid responses were obtained, and the data were coded and fed into SPSS for analysis.

Statistical Treatment of Data

SPSS has been used to analyze the data as follows:

- Means and standard deviations were used for the first question to know the level of AI literacy, Academic anxiety, and self-regulated learning.
- Pearson's correlation coefficient was employed to explore the correlation between AI literacy and academic anxiety when answering the second question.
- Pearson's correlation coefficient was employed to analyze the correlation between AI literacy and self-regulated learning in answering the third question.
- A p-value of .05 was considered statistically significant.

Limits of the Study

The study was limited to:

1. Undergraduate students of Al Esra University.
2. A sample of 80 students is being taken.
3. Students who have experience with the use of at least one AI-supported application in an academic context.
4. AI literacy and academic anxiety variables, and self-regulated learning variable.
5. Self-report questionnaire data.
6. Descriptive correlational cross-sectional design.

Findings

Results of the first question: The objective of this study is to answer the question: "What is the level of student AI literacy, academic anxiety, and self-regulated learning at Al Esra University?"

Means and standard deviations were calculated for the items and overall scores of the three scales. Mean scores were interpreted as low from 1.00 to 2.33, moderate from 2.34 to 3.67, and high from 3.68 to 5.00.

Table 1: Means And Standard Deviations of the Study Tool Items

Variable	No.	Item	Mean	SD	Level
AI literacy	1	I knew there could be inaccuracies in the information provided by AI.	4.18	0.69	High
	2	I was able to choose the right AI tool for a particular school activity.	3.99	0.72	High
	3	I could communicate clearly, knowledge-based responses to academic prompts.	3.90	0.78	High
	4	I might point out that I could modify my prompt to improve an AI response.	3.82	0.79	High
	5	There are tips and resources. I compared the information generated by AI with reliable academic sources.	3.64	0.88	Moderate
	6	I could recognize information that could be incorrect, as produced by AI.	3.51	0.91	Moderate
	7	I know that there could be bias in AI-generated content.	3.59	0.86	Moderate
	8	I was aware of the instances in which it is inaccurate to use AI for an academic assignment.	3.86	0.82	High
	9	I used AI applications, providing my personal information in a secure way.	4.11	0.73	High
	10	I understood the academic-integrity requirements related to AI use.	4.06	0.76	High
	11	Courtesy regarding the AI-generated information—I did not present it as 100% my own work.	3.78	0.84	High
	12	I offered not to and did not use AI to replace my own thinking.	3.94	0.81	High
Academic anxiety	1	If you have multiple tasks to complete, I would consider myself worried.	3.69	0.89	High
	2	It's when I was concerned about not doing well in school that I began to get anxious.	3.61	0.91	Moderate
	3	It was hard for me to pay attention when I was preoccupied with schoolwork.	3.31	0.94	Moderate
	4	I was stressed out during work tasks.	3.49	0.88	Moderate
	5	I feared that I would be incorrect when trying to learn those academic duties.	3.57	0.86	Moderate
	6	The workload of schoolwork gave me an overwhelming feeling.	3.74	0.93	High
	7	I was worried when I didn't know academic ideas.	3.38	0.90	Moderate
	8	I was afraid I wouldn't meet my teacher's expectations.	3.42	0.92	Moderate
	9	I wasn't always sure if the information that was used in assignments was correct.	3.25	0.87	Moderate
	10	I had some anxiety when I didn't know the technology needed to do an academic task.	3.11	0.96	Moderate
Self-regulated learning	1	I determine my objective before I start a schoolwork assignment.	4.01	0.77	High
	2	I have made a strategy for finishing challenging tasks.	3.84	0.83	High
	3	I chose learning strategies that coincided with the task requirements.	3.76	0.80	High
	4	I was organized with my studying.	3.91	0.82	High

	5	I tracked my comprehension of what I was learning.	3.88	0.78	High
	6	When my strategy of learning was not working out, I changed it.	3.69	0.87	High
	7	Despite it being hard to do an academic chore, I continued to work.	3.55	0.91	Moderate
	8	I asked for help when I didn't know how to do something for school on my own.	3.96	0.81	High
	9	I made connections to new information with information I already had.	3.80	0.79	High
	10	I have assessed the quality of my work prior to submitting it.	4.12	0.71	High
	11	I received feedback and responded to it to enhance my academic work.	4.07	0.74	High
	12	Consider why something worked or did not work and what needs to be done to make it happen again if it needs to.	3.62	0.88	Moderate

Table 2. Overall Means and Standard Deviation of the Study Variables

Variable	Mean	SD	Level
AI literacy	3.87	0.57	High
Academic anxiety	3.46	0.63	Moderate
Self-regulated learning	3.85	0.55	High

Table 2 indicated that the AI literacy gained status first place, mean = 3.87 and high, then, self-regulated learning, mean = 3.85 and high. The academic anxiety mean was 3.46 and had a moderate rating. The item results indicated good student awareness of the potential for inaccuracies with AI-generated information and awareness of privacy and academic-integrity requirements. But they were uncertain about identifying if the information generated by the AI was accurate or biased. The primary sources of anxiety were academic deadlines and several academic tasks. In the area of self-regulated learning, ratings for the students were high for the evaluation of their work and high for their utilization of feedback, but moderate for persisting in challenging tasks and/or reflecting on tasks they completed. Thus, the results showed that the students of Al Esra University were at high levels of AI literacy, self-regulated learning, and a moderate level of academic anxiety.

Results of the second question: What is the statistical relationship between AI literacy level and academic anxiety of students in Al Esra University?

Pearson correlation was used to analyze the correlation between AI literacy and academic anxiety.

Table 3. Pearson's Correlation Between AI Literacy and Academic Anxiety

Variables	AI Literacy	Academic Anxiety
AI literacy	1.00	-.47**
Academic anxiety	-.47**	1.00

Note. N = 80. $p < .01$.

A correlation measure presented in Table 3 indicated that there was a moderately significant negative relationship between AI Literacy and academic anxiety, with $r = -.47$, $p < .01$. This suggested that there was a negative correlation between AI literacy level and academic anxiety. So, the second question was answered, that there was a statistically significant negative relationship between AI literacy and academic anxiety among university students at Al Esra University.

Results of the third question: Do students at Al Esra University have a statistically significant relationship between AI literacy and self-regulated learning?

Pearson correlation was used to analyze the correlation between AI literacy and self-regulated learning.

Table 4. Pearson's Correlation Between AI Literacy and Self-Regulated Learning

Variables	AI Literacy	Self-Regulated Learning
AI literacy	1.00	.61**
Self-regulated learning	.61**	1.00

Note. N = 80. $p < .01$.

A strong and statistically significant positive correlation was found between AI literacy and self-regulated learning ($r = .61$, $p < .01$) as presented in Table 4. This suggested that self-regulated learning skills were higher at a higher AI literacy level. Thus, the answer to the third question was that there is a relationship between AI literacy and self-regulated learning by students at Al Esra University, which is proven statistically in terms of two variables; the relationship between them is statistically positive.

Discussion of the Results

The results revealed that students' AI literacy at Al Esra University was at a high level, whereas the Academic anxiety was at a moderate level, while the level of the students' self-regulated learning was at a high level. The results showed that there was a statistically significant negative relationship between academic anxiety and AI literacy and a statistically significant positive relationship between self-regulated learning and AI literacy. The high AI literacy generally reflected a high level of understanding of the capabilities and limitations of AI, as well as students' ability to choose the right tools, generate valuable prompts, safeguard their personal information, and grasp academic integrity expectations. They did, however, have a "moderate" capacity to detect inaccurate or biased information created by AI. This finding was consistent with the study by Shi et al. (2024), which revealed that AI literacy made a positive impact on writing performance and well-being, and with the study by Thiangtham et al. (2024) indicating strong relationships between AI literacy and self-regulation, self-efficacy, and critical thinking. It also confirmed the findings of Dang and Nguyen (2024) that report students' use of AI to simplify, brainstorm, and draft, but also noted challenges in terms of accuracy and prompting. The moderate level of assessing information produced by AI is aligned with studies by Klingbeil et al. (2024) and Zhai et al. (2024), which suggested that the over-reliance of AI on information from unverified sources could lead to a reduction in critical thinking and independent reasoning.

The medium academic anxiety was in line with the findings of Batool et al. (2024), which identified a negative correlation between AI anxiety and self-efficacy and academic performance. It also aligned with Almaiah et al. (2022) and Ijaz and Ishaq (2024), who reported that technological complexity, privacy, Academic dishonesty, and uncertainty are anxiety factors. It also concluded that students who had better Digital competency and self-regulation exhibited less AI anxiety, which aligns with the findings of Karaoglan Yilmaz et al. (2024). Likewise, Farmanesh et al. (2023) identified strong associations between AI literacy, anxiety management, engagement, and self-efficacy, and Zafar et al. (2024) reported that the use of AI negatively predicted learning anxiety and had a positive impact on emotional regulation. Mariano (2023) further reported positive relationships between AI adoption and academic buoyancy and psychological well-being. But this finding does not align with that of Wu et al. (2024), who found that with an increase in AI literacy, protection from anxiety-related outcomes does not always happen. In their study, there was some evidence that high levels of literacy also created greater awareness of the current limitations in technology and comfort zone gaps, which would exacerbate the level of pressure on self-evaluation. This discrepancy may reflect two distinct research models, with the former between the present study and the latter conducted by Wu et al., investigating a moderated mediation with the mediators being AI anxiety, self-efficacy, and dependence.

The level of self-regulated learning represented the general mastery of goal setting, planning, monitoring, using feedback, and evaluating students' work. This finding is consistent with Balouch et al. (2023), who reported that planning, monitoring, and reflective learning had a positive relationship with the use of AI. Additionally, this is congruent with Wei (2023), who found that self-regulated learning, motivation, and academic achievement have improved through instruction with the help of AI. Kanapathipillai et al. (2024) also reported that time-management skills complemented the educational values of AI. The strong positive association between AI literacy and self-regulated learning supported the results of Shi et al. (2024) that AI literacy and self-regulated learning had a positive effect on writing scores and the findings of Thiangtham et al. (2024), which showed that there was a strong positive relationship between AI literacy and self-regulated learning and autonomous learning. It also echoed the findings of Chan and Hu (2023) and Xie (2023) that knowledge of AI facilitated the planning, monitoring, and regulation of learning. In other words, Wang et al. (2024) also found that there was a strong relationship between AI literacy and SRL, but their model indicated that SRL is a mediating pathway between AI and AI literacy. Moreover, Liu (2024) discovered that elevated self-regulated learning lowered reliance on AI, which suggests that students with greater AI literacy may be utilizing AI as a tool for learning instead of taking it as a replacement for their own thinking.

However, there was a positive relationship noted in the present study, whereas Abuzaid et al. (2022), Klímová et al. (2023), and Zhang et al. (2024) found a negative relationship with an overuse of AI, as it may reduce creativity, time management, and the ability for independent study. This discrepancy may be attributable to the difference between AI literacy and AI use frequencies. The present study was focused on the "critical, responsible, and purposeful" use, as contrasted with the conflicting studies emphasizing excessive or "controlled" dependence. The results largely confirmed the notion that AI literacy was a significant psychological and educational factor related to reduced academic anxiety and increased SRL. However, moderate academic anxiety and weaker critical evaluation found that there was a need to include university programs that integrate AI-literacy training, with verification skills, ethical guidance, emotional support, and integration of activities that would help reinforce persistence and independent thinking skills.

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