University Students' Awareness and Attitudes toward the Use of Artificial Intelligence Applications (AIAs) in Learning: A Descriptive Study

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***Abstract*—In recent years, Artificial Intelligence Applications (AIAs) have become integral to education, enhancing learning and teaching. However, there is still a significant gap in understanding students' awareness and attitudes towards AI, especially in developing countries. This study aimed to explore the awareness of students at The University of Jordan (UJ) regarding AIAs and their attitudes toward their use in learning. A descriptive analytical approach was employed to achieve the study's objectives. A questionnaire was developed, and its validity and reliability were verified before being distributed to a sample of 117 students at UJ during the 2023–2024 academic year. The study results indicated that the degree of students' awareness and their attitudes towards the use of AIAs in learning were high across all dimensions of the study instrument. Additionally, no statistically significant differences were found in the degree of students' awareness and their attitudes towards the use of AIAs in learning due to the study variables: gender, academic level, and high school specialization. An important implication of this study is that the high levels of awareness and positive attitudes toward AIAs among students present a valuable opportunity to be leveraged by educational institutions. AI can be integrated into classrooms, personalized learning tools can be developed, infrastructure can be enhanced, and teachers can be trained to improve the learning experience and elevate the quality of teaching. Recommendations were made to encourage the continued use of the latest AIAs to enhance learning.**

***Keywords*—artificial intelligence applications, university students, attitudes, awareness**

I. Introduction

Globalization is driving a vast and complex scientific revolution in the modern world, significantly transforming several sectors, including social, health, and education. Advanced economies are racing to bring about change and development within their societies by modernizing state systems in all areas to keep pace with technological developments. Technological and cognitive progress -now widely accessible - is no longer hidden from anyone. Instead, it represents a qualitative leap towards embracing new technologies and entering the era of digitization and the knowledge society [1, 2].

According to Abu-Khatwa [3], the world has recently witnessed unprecedented rapid change, driven by cognitive, scientific, and technological advancements. These developments have enhanced humans' capabilities in generating knowledge and innovating technological applications. Abu-Khatwa [3] further notes that smart learning is a natural outcome of the growing progress in Information and Communications Technology (ICT). Smart learning is grounded in the concept of AI and its multiple applications that aim to maximize the benefits of the educational process. Kabdani and Baden [4] emphasize that Artificial Intelligence Applications (AIAs) are likely to shape the future of modern education, given their potential to enhance learning outcomes and improve achievement. AI has evolved beyond being just a branch of science or a set of algorithms; it is now seen as part of a new industrial revolution. Consequently, the expansion of AI in the education sector depends on increasing partnerships between governments and boosting investments to meet the demands of the modern era.

Refaat [5] defines AI as a science focused on developing electronic systems that exhibit human-like intelligence, enabling them to think, make decisions, and act in ways suited to the tasks they are assigned. Sherif [6] defined AI as a modern branch of computer science, part of the fifth generation, that emulates human cognitive processes. This enables AI systems to solve problems and make decisions based on an organized, logical approach that mirrors human reasoning, relying on the collection and organization of data to represent knowledge and information through algorithms.

Chen *et al.* [7] and Al-Husseini [8] discuss the extensive use of AI in education, starting with computers and related technologies and evolving into smart education systems. These include web-based and online intelligent education platforms, human-like robots, and chatbots. Shen highlights that these AIAs have improved learner performance, either independently or with trainers, and enabled teachers to handle administrative tasks, such as reviewing and grading assignments, more effectively and efficiently. This, in turn, helps achieve higher quality in educational activities. Additionally, Ravi Kumar and Raman [9] suggest that AIAs will have a significant impact on modern education, as they enhance courses with smart technology and shift attitudes and perspectives toward traditional education.

Shaili [10] explains that AI plays a significant role in enhancing education and developing the skills of teachers, students, and administrators. This is achieved through the creation of modern, high-quality curricula and online courses. Additionally, AI supports essential content creation and teaching skills, assists students in building key competencies, and reduces teachers' workloads by automating tasks like

grading exams and evaluating assignments. Kharshi and Al-Zawawi [11] note that one of the most effective ways to innovate in education is by integrating AIAs into the teaching process. This enables lessons to be delivered to students in simpler, more engaging, and innovative ways. Such integration can be achieved by using digital tools and media, including videos, infographics, interactive presentations, and collaborative experiences, which facilitate ongoing communication between students and teachers and enhance the educational experience. Al-Atl *et al.* [12] affirm that AI, a core computer-based science, significantly impacts education. By connecting, categorizing, distinguishing, and clarifying learning areas within neural networks, AI creates a paradigm shift in knowledge building, which positively influences student success.AI has become widely applied in education due to its enormous potential that provide unique opportunities in educational practices [13].

Holmes *et al.* [14] explain that AI has recently undergone several paradigms shifts and can be categorized into three models: AI-driven, where the learner is a recipient; AI-powered, where the learner is a collaborator; and AI-enabled, where the learner takes a leadership role. In each model, AI techniques address educational challenges in different ways, helping to represent knowledge models and facilitate cognitive learning. Holmes *et al.* [14] further notes that AI was originally developed to encourage learners to reflect on their learning and enable AI systems to adapt accordingly. Additionally, AI in education applies technology to generalize learning approaches, automate certain educational practices and assumptions, and design applications that fulfill or reduce many of the teachers' responsibilities.

Shaili [10] emphasizes that AI plays a crucial role in education by offering a broad selection of pre-made software for self-directed learning and internet-based, teacher-supported education. It also provides teachers with easy access to a wealth of online studies and e-books, enhancing knowledge sharing and supporting their professional development. Additionally, AI fosters collaboration among educators, enabling them to exchange ideas, tackle challenges, and explore contemporary teaching practices, all of which contribute to improving the educational experience. Mohsen [15] emphasizes additional benefits of AI, such as offering diverse, tailored educational materials that meet individual student needs, supporting data analysis, tracking student interactions, and enhancing assessment and feedback methods. Furthermore, Mohsen [15] explains that AI strengthens scientific research by utilizing big data analysis to guide researchers toward innovative, impactful topics, foster scientific collaboration, and provide sustainable, evolving resources for education and research.

Al-Saeed [16] highlights that the emergence of advanced AI models in recent years has profoundly impacted education and educational research, offering powerful tools to support both fields. According to Al-Saeed [16], these AI models can assist in answering test questions, writing articles, explaining complex topics, providing virtual private lessons, practicing languages, learning programming, and solving technical problems across scientific, health, and humanities disciplines. Mohammad [17] adds that the increasing importance of AI is driven by the vast amounts of data generated by researchers, which exceeds an individual's capacity to process and interpret and is essential for making complex decisions. AI's significance also lies in its ability to automate learning, handle repetitive and high-volume tasks, and enhance the quality of many products we use daily.

Several survey studies, such as those by Harry [18] and Chew [19], reveal current and future AI trends related to teachers' experiences and observations of using AI in their classrooms. These trends suggest the creation of more dynamic, interactive educational content and engaging, comprehensive learning experiences that aid in concept mastery. They also highlight the potential for teachers from diverse backgrounds to harness AI as part of their teaching, streamline administrative tasks, and provide timely feedback. Additionally, there is growing interest in human-centered, social-emotional teaching, personalized and self-directed learning, reduced lesson planning time, and the design of innovative assessment tasks. Finally, these trends indicate a shift toward using augmented and virtual reality to enhance educational environments and increase student engagement.

Al-Qahtani and Al-Dail [20] indicate that integrating AIAs into education is a recent trend that boosts students' motivation to learn and fosters their desire to acquire new knowledge, potentially enhancing their talents. Additionally, the study suggests that AIAs can support the development of higher education. However, the success of these applications largely depends on students' positive awareness of their value, as their attitudes and beliefs about using AIAs influence how they interact with and utilize them. Therefore, the study explores the awareness of The University of Jordan (UJ) students regarding AIAs and their attitudes toward using them in learning. This information is intended to help decision-makers, educators, and students assess the readiness to adopt such applications in educational settings.

There are various AIAs designed to support educational and learning goals. Personalized learning is one such area where AI tailors the learning experience to individual students, adapting to their specific needs and learning styles. For example, Century Tech uses data analysis to create customized educational plans that address knowledge gaps and provide personalized study recommendations [21]. AI also plays a significant role in task automation, streamlining administrative and educational duties like grading. An application such as Gradescope employs machine learning to automate grading, freeing up more time for teachers to focus on instruction [22]. Another application is virtual private lessons, where AI tools like Cognii offer interactive sessions that provide instant feedback and foster critical thinking skills through conversation [23]. In addition, AI contributes to smart content creation, generating educational materials that align with students' skill levels. Knowji is one such tool, offering interactive resources that help language learners study more effectively [24]. AI-powered chatbots, such as Ivy Chatbot, offer 24/7 support to students, answering questions about classes, registration, and tuition fees without needing continuous human assistance [25]. Lastly, AI can analyze student performance and generate personalized recommendations to improve learning. Socrat is an example of an application that tracks student progress and offers

tailored feedback based on data analysis [26]. Despite the many benefits of AIAs in education, Lim *et al.* [27], along with Tseng and Warschauer [28], have highlighted several concerns associated with their use. Among the key concerns are ethics, as the use of AIAs raises questions about the content they generate. While some applications aim to reduce plagiarism, human editing and review remain essential to ensure the quality and credibility of the output. Legal issues also arise, particularly regarding copyright when AI-generated content is used for commercial purposes. Innovation is another concern, as the effectiveness of AIAs depends heavily on the data input. This reliance can sometimes result in repetitive or stereotypical content that lacks creativity, potentially limiting students' academic engagement and growth. Lastly, accuracy is a significant issue, with AI-generated texts sometimes containing errors that undermine their reliability.Additionally, since AI models are trained on vast amounts of data, they can sometimes reflect biases in the resulting texts. Furthermore, excessive reliance on AIAs in education can lead to a decline in critical thinking skills, a lack of independence in learning, and reduced social interaction [29].

Abbas *et al.* [30] propose several strategies to address the concerns and limitations of AIAs in education. One approach is to diversify data sources in order to reduce bias and improve accuracy. Another strategy involves strengthening students' critical thinking and problem-solving skills to mitigate any potential lack of contextual understanding resulting from AI use. Additionally, they recommend implementing strong data protection and security measures, prioritizing ethical considerations, and offering the necessary technical support and training to ensure that both teachers and students can use AIAs effectively, with access to specialized software and computing resources.To understand this investigation better, the researchers reviewed relevant literature and studies, listed chronologically from newest to oldest:

Jaboob *et al.* [31] examined the impact of AIAs on students' academic performance by analyzing student behaviors in higher education institutions across the Arab region. A quantitative, descriptive approach was used to collect data from various Arab countries. The findings indicated that AIAs have a positive and significant effect on students' academic achievement. Additionally, students' behavior strengthens the relationship between AIAs and cognitive achievement.

Al-Hanaki and Al-Harithi [32] identified the role of AIAs in education from the perspective of computer teachers through a descriptive survey of 85 female secondary school teachers in Riyadh. The findings revealed that most AIAs related to smart educational games, while the least pertained to image technology. Challenges included inadequate technical support and high costs for classroom preparation.

Turkey [33] explored obstacles to using AI algorithms in gifted education, offering suggestions for future potential. A survey with 34 items was distributed among 110 students from King Abdullah Schools of Excellence in southern Jordan. The results indicated moderate actual utilization of AI technology and significant agreement on the challenges faced.

Alzahrani [34] examined Taif University students' perceptions of AI in higher education using a quantitative approach. A study guide was distributed to 350 students, revealing that despite perceived risks negatively affecting attitudes, expected performance and enabling conditions significantly influenced their views on AI use in the classroom.

Al-Masry [35] investigated how AI can enhance services for UJ students, using a descriptive-analytical method with a sample of 410 students. Findings showed moderate use of AI technology and service quality, with significant differences based on academic degrees favoring higher diplomas and master's degrees.

Ravi Kumar and Raman [9] assessed the opinions of business administration diploma students (682 total) on AI in higher education through online surveys. Results indicated positive views on AI's usefulness in academic administration and instruction but suggested that certain processes should not involve AI.

Dergunova *et al.* [36] focused on students' AI knowledge using a qualitative approach with 98 engineering students from Kazakhstan. Findings revealed high awareness of AI but limited understanding of related concepts, alongside concerns about AI as a new technology.

Tilly and Al-Hasani [37] defined AI, discussing its domains, features, significance, and educational applications through a theoretical literature review. Recommendations for implementing smart education included updating school infrastructure and computerizing curricula.

Kairu [38] evaluated students' opinions on AI at the University of North Texas. Of 385 respondents, 49.48% believed AI would negatively impact learning, while 39.06% thought it would be beneficial. The study concluded that AI's potential in higher education has yet to be fully realized.

Based on a review of prior research, this study examined the role of artificial intelligence in the educational process, similar to most studies, including the work of Al-Hanaki and Al-Harithi [32]. However, it explored different applications of AI in education than those presented by Shaili [10]. The methodology used in this study aligned with that of Al-Hanaki and Al-Harithi [32] but differed from that of Alzahrani [34]. In terms of the study population, this research was comparable to that of Al-Masry [35] and Turkey [33]. In conclusion, to the researchers' knowledge, this study is the first to investigate awareness of AIAs and attitudes toward their use in learning from the perspective of students at a higher education institution in central Jordan.

The problem addressed in this study arises from the growing emphasis on integrating Artificial Intelligence (AI) into higher education to enhance learning outcomes and adapt to advancements in digital technology. While AI holds the potential to redefine the roles of teachers and students—encouraging critical thinking, fostering creativity, and promoting lifelong learning—the practical implementation and impact of AI in education remain underexplored. Despite its recognized importance, the extent to which AI is effectively utilized in higher education, particularly in terms of fostering independent, adaptable learners, has not been fully realized or evaluated.

Previous studies, such as those by Tilly and Al-Hasani [37] and Turkey [33], have highlighted the importance of focusing

on AI's applications in education and providing platforms for stakeholders—including educators, students, and technology leaders—to discuss AI's capabilities and challenges. UNESCO has also urged governments to regulate AI use in education and ensure adequate training for educators [39]. Additionally, research by Kuka *et al.* [40] and Al-Farani and Al-Hujaili [41] emphasize the necessity of equipping students with skills like machine learning, data analysis, and ethical awareness to prepare them for a workforce increasingly shaped by AI.

However, despite these initiatives, a gap remains in understanding students' awareness of AIAs and their attitudes toward its use in the educational process. While students generally believe in AI's potential to enhance educational quality by improving access to knowledge and supporting skill development [9, 42, 43], evidence suggests that AI is not being utilized to its full potential, and its specific applications and impacts are not well-documented [35]. Furthermore, the extent to which students are prepared to critically engage with AI technologies, including addressing ethical concerns like bias and privacy, is unclear.

This study aims to address this gap by analyzing the awareness and attitudes of University of Jordan (UJ) students toward AIAs in learning. By exploring how students perceive and engage with AI, the research will provide valuable insights into the opportunities and challenges of integrating AI in higher education. The findings will inform the development of strategies for maximizing AI's potential while addressing students' needs and concerns, thereby contributing to more effective and inclusive educational practices. So, this study seeks to answer the following questions:

1) What is the degree of students' awareness at UJ regarding the use of AIAs in learning?
2) What are the students' attitudes at UJ towards the use of AIAs in learning?
3) Does the degree of students' awareness at UJ regarding the use of AIAs in learning differ according to gender, academic level, and high school specialization?
4) Do students' attitudes at UJ towards the use of AIAs in learning differ according to gender, academic level, and high school specialization?

This study aims to explore the degree of students' awareness at UJ regarding the use of AIAs in learning. Further, the students' attitudes at UJ towards the use of AIAs in learning. Furthermore, the degree of students' awareness at UJ regarding the use of AIAs in learning according to gender, academic level, and high school specialization. Finally, the students' attitudes at UJ towards the use of AIAs in learning according to gender, academic level, and high school specialization.

The importance of this study in its theoretical aspect stems from filling the knowledge gap related to the degree of students' awareness of AIAs and revealing their attitudes towards using them. The educational uses of AI are no longer a luxury, but rather an urgent need considering smart technological development and the subsequent rapid changes in the use of technology in education. In addition, it is expected that this study will open the way for researchers to conduct other similar studies to reveal students' awareness in public schools of using AIAs and their attitudes toward using them. The applied importance stems from the possibility that the results of this study contribute to encouraging faculty members and students at UJ to employ AIAs in learning, since awareness and attitudes towards employment are high. Further, it is expected that this study will benefit decision-makers at UJ in identifying the degree of students' awareness of using AIAs and their attitudes toward using them, to issue decisions that will stimulate and enhance the use of AIAs in teaching and learning effectively.

This study systematically progresses through three key sections: Methodology, Results and Discussion, and Conclusion and Implication. The Methodology section outlines the research design, participant selection, data collection methods, and analytical approaches employed to ensure a rigorous investigation. Following this, the Results and Discussion section presents the study's findings, accompanied by an in-depth analysis and interpretation in the context of existing literature. Finally, the Conclusion and Implication section synthesizes the key insights, offering a concise summary of the study's contributions, practical applications, and recommendations for future research, emphasizing its relevance and impact within the field.

II. Methodology

The descriptive survey approach was used in this study to explore the awareness of UJ students regarding AIAs and their attitudes toward their use in learning. As noted by Babbie [44], descriptive surveys offer researchers valuable methods to understand various phenomena within a population or sample. They enable researchers to gather data on relevant variables and describe their characteristics without necessarily establishing causal relationships. This approach is especially useful in exploratory research or when the objective is to gain insights into a specific topic or population.

A. Study Population and Sample

The study population consisted of all students of the Faculty of Educational Sciences at UJ for the academic year of 2023/2024. An available sample of 117 male and female students was selected. The ages of these students range from 18 years and above. These students belong to various departments in the college, such as curriculum and instruction, library science, special education, and educational psychology. The student community for this study is highly homogeneous, with most students coming from similar socio-economic and cultural backgrounds. Additionally, their prior knowledge of technology and academic backgrounds are closely aligned, as the majority have a foundation in literary studies from high school. This homogeneity suggests that the sample size is adequate for the study's purpose. According to Andy [45], having 5 to 10 individuals per item is generally acceptable. Furthermore, the availability of 100 participants meets the sample adequacy requirements based on The Kaiser-Meyer-Olkin (KMO) criterion. Table 1 demonstrates the numbers of the study sample according to the classification variables.

B. Study Instrument

The researchers reviewed educational literature and

previous studies [36, 46–50] to develop a study instrument (questionnaire) (click here to see it) that consisted of 59 items. This instrument included three sections: the first covers demographic information about students, such as gender (male, female), academic level (undergraduate, graduate), and high school specialization (literary, scientific). The second section was to measure students' awareness of AIAs in learning, and it consisted of four areas: awareness of the concept of AI, awareness of the capabilities of AIAs to support learning, awareness of the negatives of using AIAs in learning, and awareness of the obstacles to using AIAs in learning. The third section was to measure students' attitudes towards using AIAs in learning, and it consisted of two areas: attitudes towards using AIAs to improve learning and teaching, and attitudes towards the importance of AIAs.

Table 1. Numbers of the study sample according to the classification variables

Variable	Variable's Level	Number	Total
Gender	Male	6	117
	Female	111	
Academic level	Undergraduate	75	117
	Graduate	42	
Specialization	Scientific	12	117
	Literary	105	

The questionnaire was designed according to a five-point Likert scale consisting of (very high degree = 5, high degree = 4, medium degree = 3, low score = 2, very low degree = 1). The following statistical criterion was used to interpret the means of the participants' answers: low degree of use (1–2.34), medium degree of use (2.35–3.66), high degree of use (3.67–5).

C. Validity

The apparent validity of the study instrument was examined by presenting it in its initial form—which consisted of (65) items—to eight arbitrators who were faculty members specialized in educational technology, curriculum and instruction, and educational psychology in Jordanian universities. These arbitrators were asked to check the clarity of the items, their linguistic integrity, and their belonging to their areas. They were also asked to express their opinions and suggestions for amendments, deletions, and additions regarding the suitability of the items for the purposes of the study. The arbitrators' observations were considered, which were unanimously agreed upon by more than 75% of the arbitrators, or the observations were essential, even if the percentage was less. After considering the arbitrators' comments, some of the linguistic formulations of the items were modified, and the items containing repeated ideas were deleted. Accordingly, the study instrument in its final form consists of (59) items, distributed over two sections: the first is about students' awareness of AIAs in learning, and it consists of four areas: awareness of the concept of AI, awareness of the capabilities of AIAs to support learning, awareness of the negatives of using AIAs in learning, and awareness of the obstacles to using AIAs in learning. The second section is about students' attitudes towards using AIAs in learning, and it consists of two areas: attitudes towards using AIAs to improve learning and teaching, and attitudes towards the importance of AIAs.

D. Reliability

The reliability of the research instrument was additionally confirmed through the utilization of the Cronbach Alpha stability parameter, which assesses internal consistency. This assessment involved administering the instrument to a preliminary sample of 30 students drawn from both within and outside the study community. The resulting Cronbach's alpha coefficient for internal consistency stability was approximately (0.94) indicating a high level of reliability suitable for the study's objectives and implementation [51]. Table 2 displays the results.

Table 2. Cronbach's alpha coefficients for reliability of sections and total

Section	Value
Students' awareness of AIAs in learning	0.090
Students' attitudes towards using AIAs in learning	0.089
Total	0.94

E. Study Variables

The study included two types of variables. First, the classified independent variables are: 1) gender (male, female), 2) academic level (undergraduate, graduate), and 3) high school specialization (literary, scientific). Second, the dependent variables are: 1) the degree of students' awareness at UJ regarding the use of AIAs in learning, and 2) the students' attitudes at UJ towards the use of AIAs in learning.

F. Statistical Treatments

The researchers utilized the Statistical Package for the Social Sciences (SPSS) for data analysis. Various statistical methods were employed to address the research inquiries. Specifically, means and standard deviations were employed to address the first and second questions, while a Three-Way ANOVA test was applied to address the third and fourth questions.

G. Procedural Definition

The use of AIAs: It is procedurally defined as the ability to leverage the technology available in AIAs, which have the potential to revolutionize the learning experience for UJ students across all specializations and courses. This can be achieved by offering personalized, engaging, and accessible educational opportunities that empower students to reach their full potential.

The degree of awareness of using AIAs in learning: It is defined procedurally as the degree of awareness, understanding, and knowledge of the study sample using AIAs. It is measured by the degree that the respondent obtains on the study instrument.

Attitudes towards using AIAs in learning: They are defined procedurally as the amount of emotional intensity shown by UJ students towards AIAs by rejecting, accepting, or hesitating to use them. They are measured by the degree that the respondent obtains on the study instrument.

H. Limitations

The study results are limited to determining the degree of JU students' awareness regarding AIAs and their attitudes toward their use in learning. Further, they are limited to the study population that involved students at school of educational sciences at UJ in the capital of Amman, Jordan, in the first semester of the academic year 2023–2024. Furthermore, generalizing the study results depends on the nature of the study instrument and its psychometric characteristics, such as the validity and reliability, the seriousness of the respondents, and their objectivity in responding to the study instrument.

This study aimed to explore students' awareness and attitudes toward AIAs in general, without focusing on specific tools or applications commonly used in their learning. The use of these applications is predominantly driven by personal preferences rather than instructor's guidance. Students independently select the type or types of AIAs that best suit their individual needs, leading to variations in the applications used from one student to another. As a result, this study sought to examine awareness and attitudes toward AIAs in general, recognizing that the choice of applications varies based on each student's unique requirements.

The university where the study was conducted does not currently provide formal opportunities for integrating AIAs into student learning. Furthermore, there is no established protocol to clarify which AIAs are permitted for academic use. Given this context, the study sought to understand students' awareness and attitudes toward AIAs in general, rather than examining specific applications, recognizing the diversity in application preferences among students.

I. Research Methodology Procedures

The study followed the procedures outlined in Fig. 1.

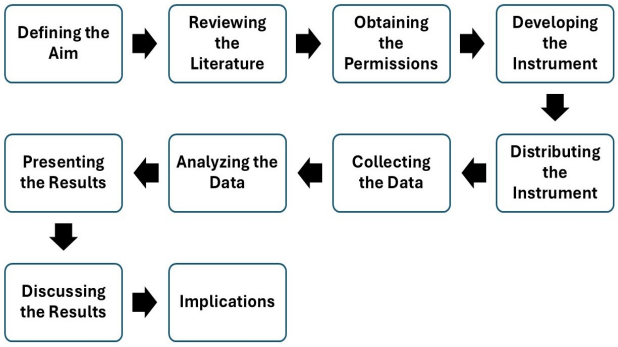

Fig. 1. Research methodology procedures.

Fig. 1 illustrates the procedures followed in this study to answer the research questions. The process began by defining the study's aim, which was to explore UJ students' awareness of AIAs and their attitudes toward using them in learning. This was followed by a review of relevant educational literature, including previous studies, to support the study's objectives. Necessary permissions and support were then obtained from UJ, including letters granting access to student statistics and data. The study instrument was developed and its validity and reliability verified before finalizing it. The instrument was then electronically distributed to the study sample via Google Forms. Data collection and analysis were conducted using appropriate statistical methods in SPSS, followed by the extraction and presentation of results to answer the research questions. Finally, the findings were discussed, and implications were drawn.

III. Results and Discussion

First question: "what is the degree of students' awareness at UJ regarding the use of AIAs in learning?"

To answer this question, means and standard deviations of the participants' responses were calculated based on areas of the questionnaire. Table 3 displays the results.

Table 3. Means and standard deviations of students' estimates of their awareness of AIAs

Area	Mean	SD	Degree
Awareness of the obstacles to using AIAs in learning	4.18	0.69	High
Awareness of the capabilities of AIAs to support learning	4.16	0.65	High
Awareness of the concept of AI	4.03	0.66	High
Awareness of the negatives of using AIAs in learning	3.81	0.66	High
Total	4.07	0.73	High

Table 3 demonstrates that means of the study instrument areas ranged between (3.81–4.18). Area of "Awareness of the obstacles to using AIAs in learning" came in first rank (M = 4.18, SD = 0.69) with a high degree. Further, the area of "Awareness of the capabilities of AIAs to support learning" ranked second with a high degree (M = 4.16, SD = 0.65). Furthermore, the area of "Awareness of the concept of AI" came in the third rank with a high degree (M = 4.03, SD = 0.66). Finally, the area of "Awareness of the negatives of using AIAs in learning" came in the last rank with a high degree (M = 4.03, SD = 0.66). In addition, Table 1 displays that the overall of the participants' responses was a high degree (M = 4.07, SD = 0.73).

These findings generally were attributed to students' learning practices during the COVID-19 pandemic, which led to the widespread use of various technological applications, including AIAs. Additionally, they reflect students' growing awareness of the importance of familiarizing themselves with these technologies, especially as they adapt to distance or blended learning environments. Another contributing factor is the prevalence of affordable smart devices among students, which often come equipped with numerous AIAs. The accessibility and popularity of these devices have fostered familiarity with AIAs among young students, who are keen to keep up with the latest technological advancements.

The results of this study align with those of Ravi Kumar and Raman [9], who found that students perceive AI as a valuable tool for teaching, learning, and academic management. However, these findings contrast with those of Kairu [38] and Dergunova *et al.* [36], which indicated that students had only a moderate level of awareness about AI. Many students also expressed concerns about the potential pros and cons of AI as an emerging technology.

Second question: "*Does the degree of students' awareness at UJ regarding the use of AIAs in learning differ according to gender, academic level, and high school specialization?*"

To answer this question, means and standard deviations of

the participants' responses were calculated. Table 4 displays the results.

Table 4. Means and standard attributed to the study variables

Variable	Variable's Level	Mean	SD
Gender	Male	4.057	0.52
	Female	4.101	0.47
Academic level	Undergraduate	4.081	0.119
	Graduate	4.078	0.118
Specialization	Scientific	4.095	0.154
	Literary	4.063	0.105

Table 4 shows that there are apparent differences between means of students' estimates of their awareness of AIAs according to the variable of gender (male (M = 4.057), female (M = 4.101)), academic level (undergraduate (M = 4.081, graduate (M = 4.078), and high school specialization (scientific (M = 4.095), literary (M = 4.063). To determine if these differences are statistically significant (α = 0.05), the Three-Way ANOVA was calculated. This is revealed in Table 5.

Table 5. Three-way ANOVA attributed to the study variables

Source	Type III Sum of Squares	Degrees of Freedom	Mean Square	F	Sig.
Between groups	320.654	1	320.654	1393.616	0.000
Gender	0.011	1	0.011	0.046	0.831
Specialization	0.011	1	0.011	0.049	0.826
Academic level	0.000	1	0.000	0.001	0.975
Error	26.000	113	0.230		
Total	1979.626	117			
Corrected Total	26.019	116			

* Statistically significant at the (α = 0.05)

Table 5 demonstrates that there are no statistically significant differences (α = 0.05) attributed to the gender variable (F = 0.046, Sig = 0.831). Further, the table displays that there are no statistically significant differences (α = 0.05) due to the specialization variable (F = 0.049, Sig = 0.826). Furthermore, the table shows that there are no statistically significant differences (α = 0.05) attributed to the academic level variable (F = 0.001, Sig = 0.975).

These findings are due to the fact that all students—regardless of gender, academic level, or high school specialization—were exposed to similar experiences, particularly in core academic subjects. The results may seem logical in terms of gender, as AI-based Assessments (AIAs) are not biased by gender. They may appear less intuitive regarding specialization, but in their early years, university students often take the same foundational courses—such as Computer Science I, Computer Science II, and Digital Skills—as part of their university requirements. This shared curriculum may foster similar levels of awareness about modern technological applications, including AI.

Additionally, these results reflect the advanced capabilities and infrastructure of higher education institutions, which enable them to adopt the latest technology-supported strategies in learning and teaching, regardless of students' gender, academic level, or high school specialization. These institutions also place significant emphasis on student engagement, especially during the COVID-19 pandemic and the period of distance learning, when many relied on modern platforms and software, including AIAs, to communicate with students and enhance the educational experience.

Although the dependent variable differs from Al-Masry's [35] study, which examined the role of AI in improving the quality of services provided to students, its results align with the current study's findings. Al-Masry's study also found no statistically significant differences based on gender. However, it did identify statistically significant differences related to academic level, favoring graduate students.

Third question: "*What are the students' attitudes at UJ towards the use of AIAs in learning?*"

To answer this question, means and standard deviations of the participants' responses were calculated based on areas of the questionnaire. Table 6 shows the results.

Table 6. Means and standard deviations of students' estimates of their attitudes towards the use of AIAs in learning

Area	Mean	SD	Degree
Attitudes towards using AIAs to improve learning and teaching	4.11	0.87	High
Attitudes towards the importance of AIAs	4.04	0.96	High
Total	4.08	0.90	High

Table 6 reveals that means of the study instrument areas ranged between (4.04–4.11). Area of "Attitudes towards using AIAs to improve learning and teaching" came in first rank (M = 4.11, SD = 0.87) with a high degree. Further, the area of "Attitudes towards the importance of AIAs" ranked second with a high degree (M = 4.04, SD = 0.96). In addition, Table 4 displays that the overall of the participants' responses was a high degree (M = 4.08, SD = 0.90).

The positive attitudes of students toward using AI Applications (AIAs) in learning were attributed to the advantages these students discovered—especially while studying some courses remotely or in a blended learning format. They found that these applications offered immense potential, improving the execution of learning activities, facilitating communication and collaboration between students and teachers, and reducing the discomfort of shy students who prefer not to engage in face-to-face communication. Additionally, these applications effectively clarified abstract scientific concepts and made them more relevant to students' lives, increasing their enthusiasm for the courses and fostering positive attitudes toward using AIAs in the learning process. Furthermore, students were able to explore their potential for self-learning, which strengthened their intrinsic motivation to learn.

The findings of Al-Zahrani [34] align with those of this study, showing that students' attitudes toward AIAs in higher education are positive. To the best of the researchers' knowledge, previous studies do not contradict these results regarding attitudes toward AIAs in learning.

Fourth question: "*Do students' attitudes at UJ towards the use of AIAs in learning differ according to gender, academic level, and high school specialization?*"

To answer this question, means and standard deviations of the participants' responses were calculated. Table 7 shows the results.

Table 7. Means and standard attributed to the study variables

Variable	Variable's Level	Mean	SD
Gender	Male	4.275	0.492
	Female	4.049	0.115
Academic level	Undergraduate	4.112	0.177
	Graduate	4.211	0.176
Specialization	Scientific	4.112	0.177
	Literary	4.205	0.157

Table 7 demonstrations that there are apparent differences between means of students' estimates of their attitudes towards the use of AIAs in learning according to the variable of gender (male (M = 4.275), female (M = 4.049)), academic level (undergraduate (M = 4.112, graduate (M = 4.211), and high school specialization (scientific (M = 4.112), literary (M = 4.205). To determine if these differences are statistically significant (α = 0.05), the Three-Way ANOVA was calculated. This is revealed in Table 8.

Table 8. Three-Way ANOVA attributed to the study variables

Source	Type III Sum of Squares	Degrees of Freedom	Mean Square	F	Sig.
Gender	0.276	1	0.276	0.542	0.463
Specialization	0.078	1	0.078	0.153	0.696
Academic level	0.261	1	0.261	0.512	0.476
Error	57.497	113	0.509		
Total	2006.243	117			
Corrected Total error	58.152	116			

* Statistically significant at the (α =0.05)

Table 8 reveals that there are no statistically significant differences (α = 0.05) attributed to the gender variable (F = 0.0.542, Sig = 0.463). Further, the table displays that there are no statistically significant differences (α = 0.05) due to the specialization variable (F = 0.153, Sig = 0.696). Furthermore, the table shows that there are no statistically significant differences (α = 0.05) attributed to the academic level variable (F = 0.512, Sig = 0.476).

The results were attributed to the lack of gender bias in AIAs. Anyone, regardless of gender, can easily access and use these applications to implement learning activities and collaborate with colleagues. This unbiased accessibility may have contributed to the convergence of attitudes among students of different genders.

Additionally, the similarity in attitudes between students with scientific and literary backgrounds in high school could be due to the university requirement for all students to study a range of similar courses that involve the use of technology and skill acquisition. This likely fostered positive, convergent attitudes toward AIAs in learning.

Similarly, the comparable attitudes across academic levels may be because students, regardless of their level, are tested on their technological skills. Those who do not pass are required to take courses to build the necessary skills. The use of AIAs is not limited to a particular academic level; students at all levels rely on these applications to complete assignments, communicate with colleagues, and collaborate in group work.

These findings align with the results of the first and second questions, which showed that students' awareness of AIAs was high, regardless of gender, academic level, or high school specialization. A high awareness of AIA usage appears to foster similar attitudes across these variables.

To the best of the researchers' knowledge, previous studies neither confirm nor contradict these findings related to the first area.

IV. Conclusion and Implication

The study findings reveal a high level of awareness and positive attitudes among students toward AIAs in their learning processes. This awareness can largely be attributed to the increased use of technology during the COVID-19 pandemic, as students relied on various technological tools, including AIAs, to continue their education through distance and blended learning formats. Additionally, widespread access to affordable smart devices has allowed students to familiarize themselves with AIAs, further enhancing their technological comfort and proficiency.

Students' positive attitudes toward AIAs in learning are also rooted in their experiences with remote and blended learning. AIAs facilitated communication, collaboration, and engagement, especially for those who might be hesitant in face-to-face interactions. Moreover, these tools helped clarify complex concepts, making the material more relatable and enjoyable, which in turn fostered greater enthusiasm for learning. The ease of self-directed learning through AIAs has also bolstered students' intrinsic motivation, as they have been able to explore their own abilities and achieve more personalized educational experiences.

The study revealed no significant differences in students' awareness or attitudes toward AIAs based on gender, academic level, or high school specialization. This uniformity may be attributed to the shared educational experiences that students undergo at the university, particularly in technology-oriented courses such as digital skills and introductory computing. These courses, which are mandatory for all students, likely contribute to a consistent level of awareness of AIAs across various demographics. Additionally, the gender neutrality of AIAs allows all students equal access and usage, which may explain the similarity in attitudes between male and female students. This uniform exposure to technology fosters a broadly positive perception of AIAs, regardless of students' academic backgrounds or personal characteristics.

Moreover, the advanced technological infrastructure within higher education institutions has made it feasible to integrate modern tools like AIAs into the educational process, further equalizing the experience across different student demographics. During the COVID-19 pandemic, for example, universities relied heavily on AI-driven platforms to facilitate

online learning, which emphasized the importance of AIAs across the board. Consequently, this consistent exposure has led to high levels of awareness and similar attitudes towards AIAs among students, irrespective of their gender, academic year, or high school specialization. These findings underscore that students with high awareness of AIAs generally develop positive, convergent attitudes toward their use in learning.

Regarding the implications of the study's findings, the finding that students exhibit a high level of awareness and positive attitudes toward AIAs is promising for the integration of these tools into academic programs. This readiness suggests that students are not only open to but may also actively engage with AIAs to enhance their learning outcomes. Universities can capitalize on this positive disposition by incorporating AIAs in course design, assignments, and research projects. Such integration could lead to improved student performance, greater technological literacy, and the development of critical skills relevant to the workforce. Furthermore, students' familiarity with AIAs can encourage collaborative learning experiences where peers support each other in using these tools, creating a community of tech-savvy learners.

The absence of statistically significant differences in awareness or attitudes toward AIAs across gender, academic level, or high school specialization suggests a widespread acceptance and uniform interest in these tools among diverse student demographics. This uniformity is an encouraging sign for educators and administrators, as it indicates that initiatives to promote AIAs could benefit the student body as a whole without needing major adjustments for different groups. This finding supports the notion that AIA-focused interventions and resources can be designed inclusively, appealing broadly and promoting equitable access to advanced learning technologies. Additionally, the lack of demographic disparity may ease the implementation of standardized AIA programs across various departments, facilitating consistency in technology-enhanced learning experiences.

The study's findings can inform university policies and strategic decisions regarding technology investments. Knowing that students generally have high awareness and positive attitudes toward AIAs, universities are justified in further investing in AIA resources, training, and infrastructure improvements. Policies that encourage faculty development and training in AIAs could also be beneficial, ensuring that both instructors and students can make effective use of these tools. The uniform acceptance across demographics suggests that resources can be allocated more efficiently without needing targeted approaches for different student groups, enabling a cohesive rollout of AIA tools and platforms.

The results of this study can serve as a foundation for further research, particularly in examining how AIAs can enhance specific learning outcomes across disciplines. Additionally, understanding how students apply their awareness and attitudes in practical learning situations could reveal best practices and potential challenges. Universities could consider conducting longitudinal studies to assess how continued exposure to AIAs impacts student engagement, knowledge retention, and academic success over time. Such research would contribute valuable insights to the field of educational technology, helping to refine AIA implementation strategies for maximum educational benefit.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

All authors contributed to the development of this manuscript, including drafting the introduction, background, methodology, results, and discussion sections, as well as writing and reviewing the manuscript. Specifically, the second author focused on preparing the introduction, background, and data collection. The first author contributed to data collection, development of the methodology, and analysis and presentation of the results. The third author was involved in data collection, interpretation of the results, formulating recommendations, providing suggestions and applications, and translating the manuscript into English. All authors reviewed and approved the final version of the manuscript.

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