Awareness of AI and its Uses in Education Among General Education Schools Teachers in Kuwait

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Abstract

The study aimed to measure the artificial intelligence (AI) awareness level of teachers in general education schools in the State of Kuwait. Additionally, it sought to explore the influence of some independent variables such as gender, type of specialization, ICT qualification, AI training courses, ICT proficiency, and professional experience on their perceptions and awareness level. The study used a descriptive analytical quantitative research methodology as its scientific research approach, which was suitable for achieving its research objectives. Data were collected using an online questionnaire, consisting of 36 items after it was validated and tested for reliability, distributed electronically to a purposive stratified sample of 1,924 in-service teachers during the first and second semesters of the 2023/2024 school year. The study revealed that the awareness level of teachers in Kuwait's general education schools regarding AI and its educational applications was generally categorized as "high/large" (M = 3.81, SD = 0.71, RII = 0.76). The results revealed that their awareness level was "high/large" for the majority of the scale items (21 items), while the remaining scale items (15 items) scored "very high/large". Furthermore, the findings showed no statistically significant differences at the significance level 0.05 ($\alpha \leq 0.05$) among the means of the in-service teachers' responses attributed to the variable of type of specialization (AHSS/literary, scientific), within the entire instrument/scale. As for the variables of gender (male, female), ICT qualification (holding an international ICT certificate, with no international ICT certificate), participation in AI training courses (attended, did not attend), ICT proficiency level (low/beginner, moderate/intermediate, high/expert/advanced), and years of professional experience (0 to < 10 years, 10 to < 20 years, 20 years and more), the results demonstrated statistically significant differences at the significance level 0.01 ($\alpha \leq 0.01$) in the means of participants' responses, in the overall tool/scale, in favor of the following: (1) the gender variable favored females, (2) the ICT qualification variable favored in-service teachers holding an international ICT certificate, (3) the participation in AI training courses variable favored in-service teachers who attended previous training courses in AI, (4) the ICT proficiency level variable showed differences between three pairwise groups, namely (low/beginner, moderate/intermediate), (low/beginner, high/expert/advanced), and

(moderate/intermediate, high/expert/advanced), in favor of participants with higher ICT proficiency levels, and (5) the years of professional experience variable disclosed differences in only one pair, namely (0 to < 10 years, 20 years and more), in favor of participants with higher years of professional experience (20 years and more). The study concluded with some recommendations, including: (1) Promoting awareness and optimal use of AI algorithms, technologies, and applications in education among teachers; (2) Conducting regular training sessions, workshops, and seminars led by experts to teach educators how to use AI algorithms, technologies, and software effectively in teaching and learning; (3) Producing and sharing educational materials like brochures and posters to introduce AI concepts, ethics, applications, and risks through traditional and social media channels; (4) Creating an interactive digital educational guide that explores the applications of AI in education; (5) Integrating AI topics into school and university curricula as well as teacher preparation and professional development and training programs; and (6) Fostering local, regional, and international collaboration among educational institutions, authorities, and AI-specialized organizations to raise awareness and share expertise in the field, enhancing coordination and partnership.

Keywords: artificial intelligence, AI, awareness level/degree, perceptions/opinions of teachers, PreK-12 education, State of Kuwait.

Introduction

Our modern era thrives in the midst of rapid technological advancement, where artificial intelligence (AI) has emerged as one of the foremost innovations shaping our daily lives. AI possesses the ability to analyze data faster and more accurately than humans, making it a powerful tool for development and improvement across a diverse range of fields. One such area that has greatly benefited from the advancement of AI is the field of education (Abdulsalam, 2021; Al Darayseh, 2023; Al Kanaan, 2021; Al-Saidi et al., 2023; International Telecommunication Union [ITU], 2020; Kim & Kim, 2022; Simhadri & Swamy, 2023; Zhang et al., 2023).

AI technology offers tremendous opportunities to enhance the processes of teaching and learning, making them easier, faster, more enjoyable, efficient, and effective. Traditional education relies on fixed curricula and significant human reliance, but with the advancement of technology, it has become possible to adapt the teaching and learning experience to a greater extent and meet the needs of learners individually and accurately. The use of AI in the educational sector opens the door to a stunning educational future that can meet the needs of today's knowledge society (Alghamdi & Alfarani, 2020; Al Kanaan, 2022; Al-Saidi et al., 2023; Ghanaiem, 2023; Kim & Kim, 2022; Samili, 2023; Simhadri & Swamy, 2023).

AI can be used in a variety of teaching and learning contexts, whether in traditional classroom settings or in online (i.e., electronic, networked, mobile, and virtual) teaching and learning environments. Here are some examples of how education can benefit from developments in the field of AI (Al Darayseh, 2023; Al Kanaan, 2021; Al-Saidi et al., 2023; Ayanwale et al., 2022; Celik et al., 2022; Simhadri & Swamy, 2023; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2019, 2020, 2021a):

1. Personalized teaching and learning: AI can provide individualized guidance to learners based on their abilities and unique needs. It can track learners' previous performance and offer tailored training to help them achieve their goals.
2. Enhancing content delivery: AI can improve the quality of educational content and develop materials suitable for learners' needs. This can make the teaching and learning processes more engaging and effective.
3. Accurate assessment: By analyzing data and learners' past performance, AI can provide accurate assessments of learners' performance and offer recommendations for improvement. This can be useful for teachers in guiding learners more effectively.
4. Enhancing distance/remote education: During the period of the COVID-19 pandemic, distance teaching and learning has become vital. AI can provide tools to support this type of education through online teaching and learning platforms and interactive systems.

5. Promoting lifelong education: AI can be a partner in enabling lifelong teaching and learning, allowing individuals to acquire new knowledge, skills, competencies, and capabilities, and benefit from continuous education opportunities.

In conclusion, the use of AI in the field of education demonstrates a revolutionary potential to enhance the quality and effectiveness of teaching and learning processes. It contributes to achieving a customized and optimized teaching and learning experience for both learners and teachers alike, opening new doors to improving the future of education and enhancing educational opportunities for all.

Problem of the Study

In an era of increasing technological innovation and rapid advancements in AI, the application of AI in education has become a crucial aspect that can bring about revolutionary changes in the educational process. However, the full benefits of these technologies cannot be realized unless educators are aware of their importance and capable of using them effectively. Therefore, it is imperative for educators to be familiar with the concept and nature of AI, its philosophy, importance, types, benefits, risks, challenges, as well as the smart technologies and software used in the field of education. They should learn how to integrate and deploy them effectively in their work environments (Al Darayseh, 2023; Al Kanaan, 2021, 2022; Ayanwale et al., 2022; Celik et al., 2022; Ferikoğlu & Akgün, 2022; Mahmoud, 2020; Mokatel & Hasni, 2021; Simhadri & Swamy, 2023).

Raising awareness among teachers about the uses of AI in education is of particular importance, as it effectively contributes to the development of the teaching and learning processes and enhances the quality of education. Here are some reasons that make raising awareness among teachers in this field necessary (Abd-Elraheem & Hassanein, 2022; Al Habib, 2022; Al Kanaan, 2021; Almalki, 2023; Al-Saidi et al., 2023; Celik et al., 2022; Ferikoğlu & Akgün, 2022; Mahmoud, 2020; Mokatel & Hasni, 2021; Zhang et al., 2023):

1. Improving learner experience: AI applications contribute to guiding learners and customizing education according to their individual needs and levels. When teachers are familiar with

how to utilize these technologies, they can enhance the teaching and learning experience for students and assist them in achieving better results.

2. Enhancing educational effectiveness and learning: Smart applications enable educators to deliver more engaging and effective educational content. AI can analyze learners' learning styles and provide diverse and suitable educational materials. This increases the effectiveness of teaching and learning processes and contributes to improving learners' performance.
3. Enhancing the ability to provide accurate assessment: Teachers who understand AI applications can benefit from them in providing accurate assessment of learners' performance. AI can be used to analyze data and provide personalized assessments that reflect each learner's individual performance.
4. Enhancing teachers' skills and competencies: Learning how to use AI applications can contribute to the development of knowledge, skills, and competencies of teachers. Teachers can become more flexible and adept at adapting to new technologies in the field of teaching and learning (education).
5. Improving employment opportunities: Teachers' knowledge of AI applications increases their opportunities in the job market. This skill or competency can be a significant focus in developing and enhancing their professional lives and achieving success in the field of education.

In the end, the importance of raising awareness among teachers about AI applications lies in enhancing the quality and effectiveness of teaching and learning processes. It paves the way for an improved educational experience that responds to learners' needs and contributes to their success. It amplifies the role of teachers as knowledge facilitators, enabling them to have a greater impact on the lives and futures of learners. Therefore, given the significance of this topic mentioned earlier, it was necessary to assess the level of awareness among teachers in the State of Kuwait regarding AI and its educational applications.

Research Questions

This study attempted to answer two main questions:

1. What is the level of awareness among teachers in general education schools in the State of Kuwait regarding AI and its educational applications in teaching and learning?
2. Are there statistically significant differences in the opinions of teachers in general education schools in the State of Kuwait and their perceptions regarding their awareness level of AI and its educational uses in teaching and learning that can be attributed to gender, type of specialization, ICT qualification, AI training courses, ICT proficiency, and professional experience?

Objectives of the Study

The objectives of the study can be summarized as follows:

1. To identify the extent of awareness among teachers in general education schools in the State of Kuwait about AI technologies and software and their uses in the field of education, as well as assessing their abilities, knowledge, skills, competencies, experiences, and readiness to integrate and employ modern smart technologies and applications in the digital teaching and learning environment.
2. To scrutinize the impact of gender, type of specialization, ICT qualification, AI training courses, ICT proficiency, and years of professional experience on the degree of awareness among teachers in general education schools in the State of Kuwat towards AI and its educational applications in the education sector.

Significance of the Study

The significance of the study can be summarized as follows:

1. This study helps measure the level of awareness among teachers in general education schools in the State of Kuwait

about AI, its technologies, software, and its uses in the field of education. Educational applications of AI have become a critical factor that can bring about a revolutionary change in the teaching and learning processes.

2. The results of this study contribute to empowering leaders of the Ministry of Education (MOE) and the Ministry of Higher Education (MOHE) in the State of Kuwait to reconsider the process of preparing teachers and their professional development programs to be in line with the nature of the digital knowledge era and the significant and rapid progress in AI technology.
3. This study aims to educate teachers in general education schools in Kuwait about various aspects of AI in teaching and learning. It covers the concept, nature, philosophy, importance, types, benefits, risks, challenges, technologies, algorithms, intelligent software, and educational uses of AI. The goal is to help teachers understand the significance of AI, acquire the skills to use it effectively, and learn how to integrate it into their teaching practices to enhance education quality and effectiveness. Ultimately, the aim is to improve learners' performance through the successful implementation of AI technologies in education.
4. This study contributes to enhancing the knowledge, awareness, skills, competencies, and abilities of teachers in the field of Information and Communication Technology (ICT) in general, and specifically in the subject of AI. It enables them to become more flexible and capable of adapting to new smart technology in the field of education, thus demonstrating it as a practice in their professional endeavors. This helps in creating a teaching and learning environment that is more realistic, dynamic, effective, positive, stimulating, enjoyable, exciting, attractive, and interactive, leading to higher efficiency, effectiveness, quality, and productivity.
5. The current study benefits the officials and leaders of the MOE and the MOHE in the State of Kuwait by allowing them to identify and determine the needs of pre-service and in-service teachers for training and professional development programs

in the field of ICT. This enables them to incorporate these needs into the professional preparation programs for teachers offered by the colleges of education, as well as into the professional development and training programs/courses offered by the MOE for teachers and educators in the field.

6. The subject of the current study aligns with contemporary global educational trends and issues in the field of educational/instructional technology, ICT in education.
7. This study is considered an invaluable resource for educational leaders concerned with providing a modern, realistic, dynamic, effective, positive, stimulating, enjoyable, exciting, attractive, and interactive educational system. It offers a rich source of information to create a digitally cognitive educational environment that is both efficient and productive, enhancing the quality and effectiveness of teaching and learning processes.
8. The current study enriches the local, Gulf, Arab, regional, and international educational research literature on its subject matter. It opens avenues for deeper intellectual and literary exploration, fostering academic, scientific, and research-based studies, thus providing new insights into the topic and its related variables.

Limitations of the Study

The limitations of the study can be categorized as follows:

1. Objective limitations: Manifested in measuring the level of awareness of teachers about AI and its educational uses in teaching and learning.
2. Human limitations: Represented in the perspectives of in-service teachers only, both male and female.
3. Spatial limitations: The study was confined to the general education schools in the State of Kuwait.
4. Temporal limitations: The study was conducted during the first and second semesters of the 2023/2024 school year.

5. Scientific limitations: Represented by the scarcity or limited availability of academic literature covering this vital subject under study in our geographical area.

Terminologies of the Study

Here are some of the concepts and terms presented in this study, along with detailed definitions and explanations, including:

1. Artificial intelligence (AI): It is the utilization or deployment of computer and digital capabilities to study how to produce machines, devices, robots, or applications that exhibit some of the qualities inherent in human intelligence—such as language understanding, image recognition, problem-solving, machine learning, inference, and learning from past experiences—and are directed and activated to perform a set of tasks, functions, and operations performed by humans. Thus, it is characterized by intelligence (Al Hiary, 2023a; Al Kanaan, 2021, 2022; Al Shaibaniya, 2019; Celik et al., 2022; Ghanaiem, 2023; ITU, 2018; Samili, 2023; Simhadri & Swamy, 2023).
2. Awareness of AI: Awareness is defined as an emotionally strong sense that guides many aspects of an individual's behavior. It is built through educational work stages in various educational levels. The more mature and stable the awareness, the more susceptible it is to support and guide rational behavior in the desired direction. AI awareness can be defined procedurally as the awareness of teachers and educators of the importance of AI in teaching various sciences, its characteristics, positive educational effects, and how to integrate its smart technologies and software into teaching and learning to ensure an innovative, creative, tailored, stimulating, interactive, enjoyable, attractive, and modern digital working, teaching, and learning environment for individuals, in addition to identifying obstacles and challenges to its effective deployment in education. The level of AI awareness is measured through a scale designed for this purpose (Al Kanaan, 2022; Ferikoğlu & Akgün, 2022).

Literature Review

Previous Studies

Below are a set of research studies that shed light on the topic of the current study: teachers' awareness of AI applications in education; among them are the following:

(1) Abdulsalam's study (2021): It aimed to investigate faculty members' attitudes at two universities in Egypt regarding the use of AI applications in education. The research used a descriptive analytical survey method with a questionnaire consisting of 58 items across three dimensions: AI applications in education, implementation requirements, and ethical risks. The study found that faculty members generally showed a "high" level of agreement toward the use of AI in education and its various applications. There were no significant differences in opinions based on academic rank among the participants.

(2) The study of Shaban (2021): It sought to understand how AI technologies can be integrated and utilized in higher education. The research reviewed the theoretical aspects of AI, its characteristics, its positive impacts on education, and its potential uses in higher education, as well as the main challenges behind its implementation in education. The study adopted a descriptive research approach to achieve its research objectives. The results indicated that there is a "low" level of awareness among faculty members and students about the importance of using AI algorithms, technologies, and applications in higher education, as they showed lack of conviction in its importance. Additionally, it highlighted the reluctance of faculty members to incorporate AI algorithms, technologies, and smart software into teaching and learning practices in higher education.

(3) The study by Aloufe and Alrehaili (2021): It aimed to investigate the possibility of using AI applications to enhance innovative capabilities in teaching mathematics for female high school students in Al Madinah Al Munawara city in Saudi Arabia, from the perspective of teachers. The study also examined the relationship of this with the following independent variables: academic qualification, years of experience, number of courses in the field of ICT, and level of technological skills. To achieve these objectives, the study adopted the

descriptive-analytical survey methodology and utilized a questionnaire as a data collection tool, consisting of 31 items. The study's stratified random sample comprised 150 female mathematics teachers. The study found that teachers have a "moderate" level of knowledge about the applications of AI in developing innovative capabilities, and that the use of these applications is of great importance to them. The results of the study also revealed significant obstacles preventing the effective use of these applications in developing innovative capabilities. The study did not show statistically significant differences in the responses of teachers to the study tool related to variables of academic qualification, years of experience, and number of courses attended in the field of ICT, while there were statistically significant differences in the level of knowledge and the importance of using smart applications, and these differences were associated with the level of technological skills, where the differences favored teachers with high technological skills. Based on these findings, the study recommended increasing the use of AI applications in developing innovative capabilities in line with teachers' awareness of their importance.

(4) The study of Ramadan (2021): It aimed to investigate how secondary school teachers in Saudi Arabia apply AI applications in education, from the perspectives of school leaders and teachers. Using a descriptive-analytical survey method, data were collected through a questionnaire comprising 53 skills across five domains. The study's stratified sample involved 386 randomly selected teachers. Results showed that teachers apply AI skills "moderately", with the highest proportions in teaching strategies, preparing the AI environment, and implementation. Additionally, there were no significant differences in AI application based on variables such as position, gender, professional experience, city, or participation in AI courses.

(5) Al Kanaan's study (2022): It tried to assess the awareness level of pre-service science teachers at Qassim University, Saudi Arabia, regarding the use of AI applications in science education. It utilized a mixed-methods approach, employing a questionnaire distributed among 43 pre-service teachers and conducting interviews with 15 of them. The study found that the overall awareness level among pre-service science teachers regarding AI applications in science education was generally

"low", with responses ranging from "low" to "very low" across different domains of the study.

(6) The study of Al Habib (2022): Its pursued objective was to understand the opinions of education experts, particularly faculty members in educational specialties at Saudi universities, regarding the use of AI in training academic staff. The study used a descriptive-analytical quantitative approach and a questionnaire to collect data from 82 experts across 18 Saudi universities. Results indicated a "moderate" level of agreement among experts regarding the use of AI in faculty training, with significant agreement on the challenges hindering its effective utilization. The study proposed recommendations for better integration of AI in academic training based on its findings.

(7) Ferikoğlu and Akgün's study (2022): It aimed to assess the awareness of AI and its integration into education among teachers in Turkish public and private schools. The study adopted a quantitative descriptive-analytical research methodology, and utilized a questionnaire called the "Artificial Intelligence Awareness Level Scale for Teachers" consisting of 51 statements. The sample comprised 561 teachers from major Turkish cities during the 2019/2020 academic year. The study revealed that Turkish teachers had a "moderate" level of awareness of AI and its educational applications, with approximately 70% showing awareness according to the scale.

(8) The study of Abd-Elraheem and Hassanein (2022): It investigated the level of agreement among Egyptian university faculty members regarding the use of AI technologies and apps for digital transformation in higher education. They used a descriptive-analytical research methodology, employing a questionnaire with 47 statements covering requirements, usage reality, and challenges of AI applications. The sample comprised 39 faculty experts from various Egyptian universities. Results showed a "strong" consensus among experts on the necessity of AI for digital transformation in higher education, and similarly, they acknowledge the challenges hindering effective and ideal usage by faculty members in Egyptian universities, though faculty usage was rated "moderately". The study proposed three scenarios for AI-driven digital transformation: extensional/referential, reformist, and innovative/fundamental transformation scenarios.

(9) Samili's study (2023): It aimed to explore how AI applications impact the professional performance of secondary science teachers in Samtah Governorate, Saudi Arabia. Using a descriptive-analytical quantitative approach, the study surveyed 103 science teachers selected randomly during the 2022/2023 academic year. Results showed that 80.2% of science teachers "strongly agreed" on the positive role of AI applications in enhancing their professional performance, including creating supportive teaching and learning environments and fostering professional growth. Additionally, the study found no significant differences based on variables like educational qualification or years of experience.

(10) The study of Zhang et al. (2023): It sought to investigate the factors influencing the intentions of pre-service teachers at a German university to use AI-based educational applications. Using the Technology Acceptance Model (TAM), the study surveyed 452 participants and found that perceived ease of use and perceived usefulness were key factors influencing behavioral intention. Additionally, the study revealed significant gender differences, with females showing higher levels of AI anxiety and perceived enjoyment compared to males. Overall, the findings highlight the importance of considering perceptions and attitudes towards AI technology in educational contexts, particularly among pre-service teachers.

(11) Al-Saidi et al.'s study (2023): It aimed to assess the integration of AI concepts and applications within the social studies curricula of post-basic education schools in Oman. The study adopted a quantitative descriptive-analytical research methodology to achieve its research objectives, using a data analysis tool/card composed of 24 statements distributed across five domains: data analysis and structuring, AI applications, AI programming, physical computing, and deep learning. The results indicated that the inclusion of AI concepts in the social studies curriculum for eleventh and twelfth grades was generally "weak". Specific findings showed "low" percentages of inclusion in textbooks, indicating a need for improvement. The study recommended the incorporation of AI concepts into educational curricula and the provision of awareness programs for teachers to enhance teaching and learning with AI technologies.

(12) The study of Safar (2024b): It sought to assess the awareness of AI among pre-service teachers at Kuwait University's College of Education and explore the impact of variables such as gender, type of specialization, ICT certification, AI training, and ICT proficiency on their perceptions. Using a descriptive analytical quantitative research approach, data from 555 pre-service teachers across three semesters—the first (fall), second (winter/spring), and third (summer) semesters of 2023/2024 academic year—were collected via an online questionnaire. Results indicated a generally "high" level of AI awareness among participants, with statistically significant differences observed in gender (in favor of males), AI training attendance (favored those who attended previous training courses in AI), and ICT proficiency (in favor of participants with higher ICT proficiency levels). The study suggests promoting AI culture among educators, offering continuous training on AI technologies and apps, integrating AI topics into educational curricula, and fostering collaboration among educational institutions and AI experts.

Commentary on Previous Studies

The current study benefited from its predecessors in constructing its theoretical framework, identifying its problem statement, methodology, and relevant concepts. It also aided in the development (design and construction) of its appropriate research instrument to gather the required data accurately and objectively. Furthermore, previous studies contributed to the selection of the most appropriate statistical methods for the current study, how to analyze them, produce descriptive and inferential statistical tables, write its results, and discuss them (in a scientific and objective manner), and draw on its recommendations and suggestions.

The current study aligns with previous studies in its research topic, focusing on AI. Previous studies have addressed various topics including the levels of awareness, understanding, and knowledge of AI, its algorithms, technologies, and software, as well as how to integrate and employ them in education, the actual usage in teaching and learning, behavioral factors that determine and influence the intention to use it, obstacles and challenges hindering its optimal application in the field of education, its availability in curricula, and other related subtopics.

Moreover, there is compatibility between the current study and previous research in the scientific research methodology used: the

descriptive-analytical quantitative research method, as well as in the adopted study tool—the questionnaire—aimed at surveying the participants' opinions and collecting data related to the research topic.

Furthermore, there is alignment between the current study and its predecessors in the chosen sample; a purposive stratified sample was selected using simple random sampling method in these studies, consisting mostly of educational and academic personnel in educational institutions, such as pre-service and in-service teachers, faculty members in institutes, colleges, and universities, as well as learners at various educational levels and curricula.

This research study contributes to the body of previous research in this field, expanding knowledge and understanding of trends, opinions, perceptions, beliefs, preferences, practices, and academic proposals regarding this vital topic in the digital knowledge era.

The current research study stands out from its predecessors in that it was implemented after a sufficient period following the COVID-19 pandemic, which caused a qualitative leap in the educational system at all levels. It necessitated the integration and utilization of ICT tools, applications, platforms, networks, and services in education to reach the stage of digital empowerment and then achieve digital transformation properly. During this period specifically, AI algorithms, technologies, and software began to penetrate all areas of life within various institutions, and their uses multiplied, including in the educational sector and its different institutes of learning.

Furthermore, it is distinguished as a longitudinal study; its data was collected meticulously and accurately over two consecutive school terms: the first semester and second semester of the 2023/2024 school year. In a longitudinal study, the researcher examines and investigates the sample individuals repeatedly to discover any changes that may occur over a period of time.

The current study also distinguished itself from its predecessors by focusing on the "awareness, understanding, and knowledge" levels regarding AI and its various educational applications in the field of teaching and learning. After investigating the academic literature, there was noted a scarcity of research studies and academic reports, both in Arabic and English, that addressed this dimension, despite its crucial importance and influential role in determining the acceptance level of

using any technology and expressing satisfaction with it, according to the results of numerous research studies (Safar, 2024a, 2024b; Simhadri & Swamy, 2023).

Additionally, the current research study differed from previous similar studies in that its data collection tool—the questionnaire—was more comprehensive and in-depth. In its final form, it consisted of 36 statements—distributed within a single study domain (awareness) in a focused manner—written with precision, objectivity, and closely related to the research topic. Therefore, it can be considered and relied upon as a comprehensive scale containing all the necessary elements to measure the level or degree of awareness among individuals regarding AI and its applications in education.

Based on this, the current study's tool (the questionnaire) can be applied to all members of educational institutions in any country (such as faculty members, administrative staff, technical supervisors, learners, and other staff, as well as parents), whether in primary (PreK-12) or higher education institutions.

Furthermore, the current study stood out from previous research by its larger sample size (compared to the size of populations and samples in previous studies). The number of participants in this study reached 1,924 participants, giving it a higher degree of representation of the study community. This enables us to generalize its results to the original study community more fully and with greater confidence.

Concept and Nature of AI

AI is a multidisciplinary field that combines mathematics, computer science, engineering, data science, and human intelligence. AI refers to the development of computer systems capable of performing tasks and processes that require human intelligence. The main goal of AI is to design systems, machines, algorithms, and software capable of executing tasks independently without human intervention and making decisions and solving problems in a manner similar to humans. AI includes various technologies and algorithms aimed at simulating human cognitive abilities, such as data understanding, inference, learning from experience, planning, making logical and constructive decisions, and problem-solving. AI relies on a variety of methods and technologies such as Machine

Learning, Adaptive Learning, Deep Learning, Artificial Neural Networks, Natural Language Processing (NLP), Language Analysis, Automated Reasoning, Mathematical Intelligence, Computational Thinking, Smart Robots, Computer Vision, Virtual Facilitators, and many others (Abd-Elraheem & Hassanein, 2022; Abdulsalam, 2021; Al Fifi, 2020; Al Habib, 2022; Al Kanaan, 2022; Ferikoğlu & Akgün, 2022; Ghanaiem, 2023; Kim & Kim, 2022; Samili, 2023; Shaban, 2021).

AI applications are used in many fields such as e-commerce, medicine, education, manufacturing, banking services, transportation, gaming, warfare, and others. These applications are characterized by the ability to analyze large amounts of data quickly and accurately and make appropriate decisions based on the derived analytics, helping to improve efficiency and increase productivity in many industries and sectors (Abdulsalam, 2021; Al Habib, 2022).

Philosophy of AI

The introduction of the term "AI" is attributed to the British scientist Alan Turing, who was a mathematician and computer scientist. In his works, Alan Turing emphasized the necessity of granting machines, in their various forms, the ability to perform tasks and exert efforts to execute tasks that are usually believed to be within the capabilities of humans. From his perspective, if the mind is the distinguishing factor between humans and machines, then machines can be programmed and equipped with instructions and software that stimulate them to perform these tasks. From this moment on, scientists began to make great efforts to simulate the traditional human mind. Although achievements were few at the beginning of this era, over time, scientists have been able to develop AI to a degree where they can build smart robots capable of achieving great accomplishments, such as the robot that defeated the world champion in the game of chess (Al Habib, 2022; Al Hiary, 2023a; Al-Saidi et al., 2023).

Types of AI

AI is a multidisciplinary field aimed at developing systems and programs that enable computer systems to perform tasks, functions, and operations that require intelligent thinking, similar to human capabilities. AI can be classified into several types, including but not limited to (Abd-

Elraheem & Hassanein, 2022; Al Hiary, 2023a; Biswal, 2023; Hawlader, 2021; IBM Data & AI Team, 2023; Joshi, 2019; Luchaninov, 2023; OpenAI, 2024; Samili, 2023):

1. Narrow/weak AI (ANI): It is a type of AI that is specific and specialized in a particular field. It is designed and programmed to perform a task or a set of tasks in a limited and defined manner. This type of AI is limited to a certain set of functions and does not possess the ability to understand language, context, or activities in general, nor can it apply its skills to other fields. An example of narrow AI is virtual assistant applications, also known as AI assistants, of which there are several types. One prominent example is voice assistants like Siri from Apple, Alexa from Amazon, or Google Assistant from Google. These voice assistants can perform specific tasks such as responding to user queries or executing simple voice commands like playing music or conducting Internet searches. However, they rely on a specific set of programmed knowledge and rules and do not have a deep understanding of language or context like humans do. They cannot perform complex activities outside their designed scope, and if asked to do so, they often fail. In summary, voice assistants use automatic speech recognition and natural language processing to provide voice responses to inquiries. Furthermore, examples of virtual assistants also include chatbot applications, which have been primarily used in the e-commerce sector since their inception. However, modern applications rely on AI, enabling them to think about customer queries rather than guiding the customer through a series of fixed events. Additionally, there are AI avatars, which are three-dimensional models designed to resemble humans and are used in entertainment applications or to humanize interactions with virtual customer support. Advanced technologies from companies like NVIDIA can produce nearly lifelike virtual human avatars in real-time. Moreover, there are domain-specific virtual assistants, specialized AI assistant applications designed for very specific industries, optimized to perform well in areas such as travel, finance, engineering, data and information security, and other

demanding sectors. Narrow AI is also widely used in applications such as classification and filtering systems (such as email filtering systems), natural language processing, and big data analysis. Narrow AI can also be divided into three main types: voice-activated, task-oriented, and anticipatory. Voice-activated assistants, like Siri or Alexa, are activated by voice commands and are designed for simple tasks such as data or information retrieval, setting alarms, or playing music. Task-oriented assistants are built for specific purposes, such as scheduling appointments or sending/organizing emails. Anticipatory assistants, such as Google Now or Microsoft's Cortana, use machine learning algorithms to anticipate user needs and provide relevant data or information and services before they are requested. In conclusion, narrow AI plays an important role in improving performance in many fields, but it remains limited to its specialized domain and does not extend beyond that.

2. General/strong AI (AGI): It is a type of AI aimed at creating intelligent systems capable of understanding and processing knowledge similarly to or surpassing human intelligence. In contrast to narrow AI, which operates in a specific and defined field of functions, general AI is multi-purpose and comprehensive, characterized by the ability to learn and adapt to a wide range of tasks and contexts. Some key characteristics of strong AI include: (a) Comprehensive understanding: Which means it can comprehend its surrounding environment comprehensively, including understanding human language naturally and responding to it in a meaningful way; (b) Self-learning capability: Meaning it can learn and develop its skills and knowledge without the need for continuous external programming; (c) Adaptation and creative thinking: Which means it can adapt to new situations and solve problems in creative ways similar to humans; (d) Consciousness: Meaning it can possess a level of consciousness that may resemble some aspects of human consciousness, such as understanding self-emotions and awareness of the surrounding environment; and (e) Social interaction: Which means it can interact naturally

with humans, understand social relationships, and culture. Moreover, this type of AI is a long-term goal for researchers and engineers in the field of AI, and it represents significant challenges due to the complexity of human understanding and the comprehensive capabilities it requires. Achieving strong AI will have a major impact on many aspects of human life and technology. Research studies and experiments in this field are expected to continue until the year 2040.

3. Super AI (ASI): It is a concept referring to a superior type of AI that surpasses entirely the capabilities of human intelligence. This type of AI is defined as more intelligent and conscious than humans in an absolute manner, capable of performing all mental and physical activities more efficiently than any human. Super AI is not merely an evolution of strong AI, but a type of advancement that makes artificial systems vastly superior to human abilities in all aspects. This includes learning, thinking, understanding emotions, and expressing them, as well as grasping advanced concepts beyond human capacity. It is worth noting that the concept of super AI remains theoretical and speculative, with no practical application currently existing. If we ever develop such a form of AI, it will have a significant impact on all aspects of human life, ranging from industry and science to social interaction and ethics. It is also noteworthy that super AI may raise security and ethical concerns, which is why there are many debates on how to regulate and implement this unique type of technology when it becomes feasible.

Objectives of AI

The objectives of AI encompass a set of primary goals aimed at developing and utilizing technology and software to create technological systems characterized by the ability to learn, think, understand, process knowledge, and make decisions in a manner similar to or surpassing human capabilities. Among the objectives of AI may include (Abd-Elraheem & Hassanein, 2022; Abdulsalam, 2021; Alghamdi & Alfarani, 2020; Al Hiary, 2023a; Simhadri & Swamy, 2023):

1. Developing intelligent systems: Which means creating and enhancing systems capable of understanding data and information and making informed decisions based on them.
2. Machine learning: Which means creating and developing systems capable of learning and acquiring knowledge by leveraging data and information gained from past experiences—through trial and error—and stored invisibly by computer devices and improving their performance over time without the need for human intervention.
3. Natural language processing: Which means producing and developing systems capable of speech, issuing gestures, cues, and reactions, as well as the ability to generate dialogues smoothly and easily without complexity, in specialized fields. In other words, creating and developing systems that have the ability to understand and produce human language naturally, contributing to the development of applications such as language translation and extracting data and information from texts.
4. Problem-solving: A characteristic of problem-solving in AI relies on a systematic process involving a series of steps to achieve a specific set of predefined objectives and solutions. This series is divided into specific solutions used to solve a particular problem without considering or addressing other issues, and general solutions that enable individuals to deal with a variety of problems immediately and solve them. Inductive reasoning and evidence deduction serve as examples of using general solutions in this context.
5. Logic and inference: The evolution occurring in the field of AI and robotics heavily relies on the ability of these systems to analyze the environment through sensory devices, whether these devices are natural or artificial. These devices play a crucial role in machines' understanding and perception of the surrounding environment. This analysis allows machines to create representations of the relationships between objects, whether simple or complex. Note that modern robots are equipped with precise visual sensors that enable them to distinguish between individuals, drive vehicles at reasonable

speeds on highways and open roads, as well as navigate easily between buildings.

6. Building models and perception: The secret to this objective lies in reaching appropriate conclusions for the situation, where reasoning branches into either deductive or inductive reasoning and decisions are made based on that.
7. Human interaction: Which means creating and developing interactive interfaces and systems that enable smooth interaction between humans and intelligent systems, such as voice assistants, robots, and AI-powered applications.
8. Computer vision: Which means creating and developing systems capable of understanding and analyzing images and videos similarly to humans, contributing to the production and development of image recognition and medical imaging technologies.
9. Diagnosis, analysis, and prediction: Today, the use of AI technologies is no longer limited to storing data and saving files only but extends to analyzing that data and reaching accurate conclusions and diagnosing the situation in a short time. An example of this is the use of AI in the medical field to improve the diagnosis and analysis of diseases and predict their progression, as well as its use in education to improve predictive diagnosis and analysis of learners' learning data rapidly and accurately and providing them with appropriate solutions. In other words, identifying learners' strengths and weaknesses and providing them with the necessary support to enhance strengths and improve weaknesses.
10. Cybersecurity: Which means producing and developing AI technologies to protect systems, networks, devices, applications, and sensitive data from cyberattacks and breaches.
11. Economy and business: Which means using AI to enhance business operations, performance, production, and services (such as support and maintenance services), increasing efficiency, productivity, and making strategic decisions.

Absolutely, these are just some of the foundational objectives of AI. The goals of AI depend on its applications or uses in various fields. AI

can be applied in fields such as healthcare, finance, education, transportation, entertainment, and many others, each with its own set of objectives tailored to address specific challenges and opportunities within those domains. The versatility of AI allows it to adapt and contribute to a wide range of industries and sectors, continually evolving to meet the needs of society and advance technological capabilities.

Principles and Ethics of AI Usage

The issue of ethics in the use of AI is of utmost importance, as AI deals with sensitive and confidential data and information, and greatly impacts people's lives and societies. Below, we present to you a set of principles and ethics that must be considered when using algorithms, technologies, and applications of AI (Abdulsalam, 2021; Bin Ibrahim, 2021; Ghanaiem, 2023; Huang et al., 2023; Jobin et al., 2019; OpenAI, 2024; Ryan & Stahl, 2021; Siau & Wang, 2020; UNESCO, 2021b):

1. Transparency: Developers and providers of AI must maintain a high level of transparency regarding how data and information are collected, processed, and used. Users should be informed about what data and information are being collected about them and how it is processed and used.
2. Privacy preservation: Ensuring the privacy of personal data and information must be guaranteed, and it should not be shared or used without explicit consent from the individuals concerned.
3. Avoiding discrimination and bias: Algorithms, technologies, and smart systems must be designed and programmed to prevent discrimination or bias based on gender, race, religion, or any other criteria.
4. Ethical responsibility: Developers and users of AI algorithms, technologies, and software must be ethically responsible for their uses in various aspects of life. They should avoid using them in unethical or illegal activities.
5. Regulation and laws: Laws, policies, regulations, and unified standards and guidelines should be developed and enhanced to govern the use of AI algorithms, technologies, and applications, directing them towards ethics and responsibility.

6. Compensation for damages: In case of errors or damages resulting from the use of AI algorithms, technologies, and applications, those responsible should compensate the affected parties.
7. Enhancing transparency in scientific research: Research studies, academic reports, and scientific findings related to AI should be published openly, without hiding or withholding necessary data and information to evaluate the impact of this emerging technology objectively and effectively.
8. Continuous learning and development: Developers and users of AI algorithms, technologies, and software must continue to learn and develop to keep pace with technological advancements in this vital field. They should contribute to improving ethics and the effective use of AI in various areas of life.

Adhering to these principles and ethics is encouraged when designing, developing, and using technology in general, and AI algorithms, technologies, and applications in particular, to ensure delivering real benefits to individuals and global society and to minimize potential risks.

The Role and Significance of AI in Education

AI offers diverse opportunities across various life domains. It is capable of enhancing production processes, services, medical diagnostics, teaching, learning, scientific research, crime prevention, data analysis, and more. It helps improve performance, efficiency, and productivity in these areas. The significance of AI is profound, as its uses and applications are significantly expanding day by day across different sectors, including the field of education (teaching and learning). This importance is evident in the following points (Abd-Elraheem & Hassanein, 2022; Al Darayseh, 2023; Al Habib, 2022; Al Hiary, 2023a; Al-Saidi et al., 2023; Ayanwale et al., 2022; Celik et al., 2022; Kim & Kim, 2022; Samili, 2023; Shaban, 2021; Simhadri & Swamy, 2023):

1. Simulating and integrating human intelligence: AI can simulate and model human cognitive processes by processing and analyzing vast amounts of data. This can contribute to the

development of interaction between humans and intelligent systems.

2. Delegating tasks to robots and devices: AI can delegate tasks and functions to robots and digital devices independently of humans. This means improving productivity and reducing human errors.
3. Facilitating the execution of difficult tasks: AI, through robots for example, can perform tasks and functions that are considered complex and difficult for humans. This includes various fields such as scientific research, medical diagnosis, system design, and industry.
4. Remote control: AI can be used to remotely control machines and digital devices, increasing efficiency and safety in many applications.
5. Enhancing learning and adaptation: AI can encourage digital devices and systems to learn, infer from data, and adapt to changes more intelligently, among other human-restricted practices and cognitive processes. This encourages continuous development and improvement.
6. Customizing education: AI can provide/enhance personalized and effective education for each learner based on their needs and level. Intelligent systems can analyze learners' performance and guide them to appropriate educational resources to help them improve their performance.
7. Providing lifelong learning opportunities: AI can provide opportunities for education and professional development throughout individuals' lives. This helps to promote continuous learning and cope with rapid world changes.
8. Improving assessment and feedback: AI can be used to provide accurate assessments of learners' performance and detailed feedback. This helps teachers understand strengths and weaknesses and take improvement actions.
9. Saving time and effort: AI can automate many teaching, learning, and administrative activities, saving time and effort for teachers and learners.
10. Accessibility: AI can provide teaching and learning opportunities for individuals in remote or deprived areas,

where access to educational materials and learning is possible online.

11. Supporting teachers: AI can provide tools and resources for teachers to analyze learners' performance and preferences, identify their cognitive gaps, provide guided support, and help them achieve their full potential.
12. Supporting learners: AI can provide tools and resources for learners to facilitate, improve, refine, and sustain their education (teaching and learning).

In summary, AI contributes to improving the quality of teaching and learning, increasing effectiveness in its processes and practices, and providing tailored educational and learning opportunities for individuals. This artificial advancement enhances the processes of teaching and learning and helps meet the needs of communities facing educational challenges.

The Uses of AI in Education

There is a great diversity in the applications of AI, as its use extends across a wide range of fields. One of the most important of these fields, which perhaps has not been fully explored by AI experts, is the field of education. Below, we present some examples of possible, useful, and very important uses of AI in the field of education as a teaching and learning tool (Abd-Elraheem & Hassanein, 2022; Abdulsalam, 2021; Akgun & Greenhow, 2022; Al Darayseh, 2023; Al Fifi, 2020; Alghamdi & Alfarani, 2020; Al Habib, 2022; Al Kanaan, 2021; Al-Saidi et al., 2023; Ayanwale et al., 2022; Celik et al., 2022; Ghanaiem, 2023; Hamdi, 2018; Samili, 2023; Shaban, 2021; Simhadri & Swamy, 2023):

1. Personalized teaching and learning: Individuals naturally vary in terms of talents, knowledge, abilities, intelligences, skills, competencies, and experiences. This variation results from differences in their capacity and speed of learning in specific areas, such as understanding theoretical concepts and linking them together, as well as mental imagery and the ability to retain terminology and information. The current education system relies on the principle of equality and fairness in teaching and learning, as everyone is required to study the same

subjects, attend the same lectures, and take the same standardized tests to assess temporary proficiency levels in certain knowledge, skills, and competencies within the subjects, regardless of learners' understanding of concepts and their ability to apply them in the future. If a large amount of data and information about each learner or group of learners is collected and linked to information and data about their backgrounds and interests, a recommendation system can be created that can predict the subjects or courses that the learner might be interested in studying and that will enhance their understanding and learning better. A personalized curriculum will be prepared for each learner and distinctive tests will be tailored to their needs. However, this approach will face challenges such as the issue of equality and fairness, as it may lead to discrimination against some individuals. It can also exacerbate the teaching and learning gap among individuals. This requires careful guidance and monitoring to ensure that these systems work fairly and effectively. Some companies and educational institutions have begun to implement teaching and learning models similar to this approach, but they face ongoing challenges in achieving a balance between customization and equality in education. In summary, AI can provide personalized and individualized teaching and learning for each learner based on their needs and individual capabilities. Smart systems can provide assignments and educational materials designed specifically to help learners progress at their own rates.

2. Understanding the stages of teaching and learning: Artificial neural network technology resembles the arrangement and neural interconnection in the brain in principle. Therefore, training these networks on a specific task and monitoring the effect of training on performance and quality can reveal secrets of the learning process itself. In the field of psychology, behavioral studies are conducted on the processes of teaching and learning. These experiments are often conducted on a narrow and difficult-to-replicate scale, and the results produced are usually difficult to prove and demonstrate. On the other

hand, training artificial neural networks is an easy and low-cost process that can be repeated thousands of times, thus allowing for accurate measurement and evaluation of the quality and efficiency of teaching and learning. By comparing these experiments with behavioral experiments and their results, a new framework for theories of teaching and learning can be developed. Based on these theories, strategies (methods and approaches) for teaching and learning and educational curricula can be created and developed in different educational stages. These newly developed theories may lead to the creation or development of an entirely different educational system from what we know currently. In short, understanding the stages of child education is a major goal in the field of behavioral psychology, as it contributes to the creation and development of theories of teaching and learning. The processes of teaching and learning can be studied from a machine learning perspective, and this approach has the potential to contribute to the creation of new theories of teaching and learning, which may require a comprehensive review of the current educational system as a whole.

3. Visual linguistic interaction with learners: With the advancement of AI technologies, it has become possible to employ modern technologies, robots, and AI software to implement the method of imitation teaching and learning in the process of educating learners. This method is used, for example, in training self-driving vehicles, where they are taught through traditional simulation of human behavior. This educational approach requires learners to engage in complex neural, muscular, linguistic, and visual interaction while attempting to interact with the machine or intelligent application. Of course, these intelligent technologies can read and understand learners' interactions and execute movements and gestures that contribute to teaching them the knowledge, skills, competencies, abilities, and experiences necessary. Although "automation of teaching and learning" is still in its early stages, it represents significant possibilities and opportunities that may lead to the emergence of a new

generation of learners who are capable of learning and acquiring knowledge more quickly and efficiently than their traditional peers. Over time, this generation may develop uniquely under the influence of AI, and it may produce unconventional or unexpected results. In summary, with significant progress in the field of AI, visual linguistic interaction between machines and learners has become one of the modern methods that contribute to teaching learners the principles of language and interaction, attributed to the advanced ability of AI to understand language and images, enabling such interaction to occur.

4. Continuous monitoring and assessment: AI can provide mechanisms for continuous monitoring of learners' performance and deliver accurate and comprehensive assessments by using tracking and electronic monitoring systems to monitor learners' performance and their level of interaction with electronic educational content. AI technologies enable teachers to track learners' activities, regularly monitor their results and grades—through automated assessing and grading—to ensure the achievement of educational goals for each subject. Additionally, it can identify their weaknesses for remediation and optimal evaluation (correction). It can also assist the teacher in monitoring and observing the development of learners' performance so that they can—when necessary—review their strategies and methods used in teaching and learning, and consider improving or developing them as needed, meaning providing feedback to the teacher. In short, this data and information can be used to help teachers and parents improve and develop the learning experience for learners.
5. Digital educational systems: These digital educational teaching and learning systems enable the effective utilization and management of rich data available from educational institutions (such as ministries of education, schools, institutes, and universities), as it can be stored in massive databases. The vast amount of data can be leveraged to train large-scale AI models to improve individual learner performance predictions

and identify resource shortages (both material and human) in educational institutions before they occur. The strength of AI primarily relies on data, which enhances the value of intelligent algorithms in making informed decisions for ministries and educational institutions. This, in turn, contributes to improving the quality of educational outcomes and reducing the costs of teaching and learning. For example, data can be collected on the number of learners in previous years, in addition to identifying the quantities of available books and analyzing their usage and retrieval rates. Using this data, future book needs for the coming years can be predicted, and resources can be allocated more efficiently, thereby reducing the annual shortages and surpluses that affect the distribution or provision of textbooks to learners.

6. Education guidance and self-learning: AI can guide learners in their education and self-learning by providing additional teaching and learning materials, as well as tailored resources based on their interests and needs.
7. Enhancing teachers' experience: AI can provide tools and applications for teachers to improve lesson planning and deliver appropriate assessments. These technological tools can help reduce administrative burden and increase interaction time with learners.

These educational uses of AI demonstrate how it can improve the quality and efficiency of teaching and learning processes, adapting better to learners' needs.

The Benefits of Using AI in Education

The use of AI in the field of education is considered one of the latest and most advanced technological developments enriching and transforming teaching and learning. Smart technologies and applications provide opportunities to enhance and improve the processes and practices of teaching and learning in various ways, offering many benefits, including (Abd-Elraheem & Hassanein, 2022; Abdulsalam, 2021; Akgun & Greenhow, 2022; Al Kanaan, 2021, 2022; Al-Saidi et al., 2023; Celik et al., 2022; Ghanaiem, 2023; Shaban, 2021; Simhadri & Swamy, 2023; Sourani, 2019):

1. Customized/personalized education: AI can provide a tailored teaching and learning experience for each learner based on their individual needs and level. It can analyze learners' performance and offer tasks, activities, and educational materials suitable for their level and preferences.
2. Sustainability enhancement: Through smart online teaching and learning platforms, learners can access educational materials, lessons, tasks, assignments, and activities anytime, anywhere, and using any smart device, increasing the possibility of lifelong learning, and promoting sustainability.
3. Performance guidance and monitoring: AI can accurately monitor learners' performance and provide reports on their progress and level. This helps teachers improve teaching and learning methods, effectively guide learners, and enhance their performance.
4. Promoting interaction and participation: AI technologies can make the teaching and learning processes more interactive by offering innovative educational methods aimed at increasing participation, interaction, encouraging competition, improving performance, solving problems, or making educational activities more engaging and enjoyable, such as active learning strategies and gamification in education (interactive educational games).
5. Providing specialized education for individuals with special needs: AI technologies and applications can provide tailored and appropriate teaching and learning for individuals with special needs, increasing their educational and learning success opportunities.
6. Improving learner assessment and evaluation: AI can be used to create and develop measurement and evaluation systems and methods for learners more accurately and fairly, relying on advanced and objective performance analysis methods.
7. Providing career guidance and counseling: AI can provide professional guidance and counseling for learners based on their skills and interests, helping them make better future decisions regarding their career paths.

8. Providing global access: AI, with its various technologies, contributes to expanding the scope of teaching and learning, reducing geographical and social gaps in access to education.

In short, the use of AI technologies and applications in the field of education contributes to improving the quality, efficiency, effectiveness, and fairness of teaching and learning. It enhances opportunities for individuals' educational, personal, and professional development.

The Drawbacks of Using AI in Education

Several drawbacks and potential disadvantages may arise from the use of AI algorithms, technologies, and applications in the field of education. Among these drawbacks are (Abdulsalam, 2021; Alghamdi & Alfarani, 2020; Al Hiary, 2023b; Celik et al., 2022; Ghanaiem, 2023):

1. Increase in costs associated with AI technologies and applications in the field of education.
2. Possibility of job reduction and increased unemployment rates among faculty members.
3. Risk of exposure to hacking and the spread of viruses in robots, devices, and smart applications used.
4. Lack of human connection, interaction, communication, and personal social adaptation among learners and teachers, which is considered an essential element in the processes of teaching and learning, potentially leading to the loss of the ability to understand individual learner needs, and limited ability to develop their human, social, and emotional skills that can be nurtured through it.
5. Learner boredom and loss of enthusiasm and desire for learning due to extensive interaction with automated systems, devices, and smart applications, as there is an increasing reliance on modern smart technologies at the expense of traditional methods.
6. Difficulty in dealing with and effectively using automated systems, devices, robots, and AI applications.
7. Negative effects on human behavior due to the confinement of human interaction and engagement with machines because of reliance on modern smart technologies.

8. The possibility of technological malfunction leading to disruption in communication and education, exposing the entire educational process to temporary or permanent cessation.
9. Increasing concerns regarding privacy and security for personal data and educational information collected and stored through AI applications.
10. Inability to determine actual progress and effective understanding of educational materials and learning on a personal level for each learner, potentially leading to a reduction in the effectiveness of the teaching and learning processes.
11. AI encompasses multiple ethical threats, risks, and biases, including deepening exclusion (based on gender and race), dehumanization, falsification, elimination of the human race, ethics of scientific research, among others.
12.

The Challenges of Employing AI in Education

Employing modern technology and AI in the field of education as a teaching and learning tool faces numerous challenges and difficulties that require careful thinking and planning to achieve the maximum benefit from these modern smart tools and technologies. Here are some of the main obstacles (Abd-Elraheem & Hassanein, 2022; Abdulsalam, 2021; Akgun & Greenhow, 2022; Al-Atel et al., 2021; Al Habib, 2022; Al Kanaan, 2022; Alrefaei & Alhadhrami, 2024; Celik et al., 2022; Luchaninov, 2023; Shaban, 2021; Zhang et al., 2023):

1. Accessible technology: Schools and educational institutions need to provide the infrastructure and access to modern technology required to implement AI applications and technologies in classrooms at different educational stages. This can be costly and may pose a barrier for many educational institutions.
2. Training and qualification: Integrating modern technology and AI into education requires appropriate training and qualification for teachers, learners, and administrators alike. This includes understanding how to effectively use or deploy

smart tools and software and integrate them into classrooms across various educational stages.

3. Suitable educational content: Suitable and appropriate educational content benefiting from AI technologies and apps should be created and developed effectively. This educational content should be interactive and inspiring for learners and teachers, based on principles of systematic educational/instructional design.
4. Privacy and security: Strong security measures must be in place to protect the sensitive and confidential data and information of learners, teachers, and administrators alike. Collecting (storing) and processing personal data and information raises several concerns regarding privacy, misuse, and the need for effective measures to protect them.
5. Human interaction: The human relationship between the teacher and the learner plays a significant role in education. The biggest challenge might be how to integrate technology and AI without negatively impacting this interaction.
6. Challenges of justice and equality: The use of modern smart technology may exacerbate the digital gap between learners, teachers, educational administrators, and educational institutions, as some may have better means and access to modern smart technology than others. This requires coordinated and concerted efforts to achieve the principle of equality and justice in access and opportunities.
7. Performance measurement and evaluation: Measuring and evaluating the impact of AI technology on improving teaching and learning performance is a challenge in itself. Methods of measurement and evaluation compatible with technology-based education must be developed and improved.
8. School culture and resistance: Schools may face resistance from some teachers, administrators, and learners to adopting modern technology and AI in classrooms at different educational levels. This requires radical cultural change and support for development, training, qualification, and professional development.

The process of integrating and deploying modern technology and AI in the field of education faces significant challenges and obstacles. However, with good planning, commitment to continuous improvement, and providing necessary support in various forms, these modern smart tools, technologies, and applications can offer important opportunities to enhance the efficiency and quality of teaching and learning. They can also empower teachers, learners, and educational leaders to develop their knowledge, skills, competencies, and capabilities better and more effectively.

Methodology

Research Design

This study adopted a descriptive analytical research methodology based primarily on a quantitative approach, which employed a survey questionnaire technique, a convenience sampling method, and descriptive and inferential statistics. This research design is considered one of the most suitable scientific research methods to the nature of this type of research studies from the perspective of a large number of researchers. It is more comprehensive than other approaches and it involves describing societal problems or phenomena as they exist in reality through comprehensive surveys of a specific segment of society. Researchers have increasingly relied on it in recent times (Abou-Allam, 2021; Creswell & Creswell, 2018; Fraenkel et al., 2019; Healey, 2016; Johnson & Christensen, 2020; Levin et al., 2016; Patten & Newhart, 2018).

Sample

A stratified random sample of 1,924 in-service teachers from all education stages of the general education schools (public and private) in the State of Kuwait participated electronically in this study during the first and second semesters of the 2023/2024 school year. The sample evidenced a similar mix of ethnic and socioeconomic backgrounds and included teachers from a variety of majors/disciplines.

Instrument

After reviewing the literature and previous research studies related to the study's topic, the research's primary instrument/scale (i.e., survey questionnaire) was designed with precision and objectivity, and it included two main sections: (1) demographic data, and (2) the AI Awareness Scale. The first section included 12 questions providing us with general demographic data revealing information about the nature of the participating sample individuals. As for the second section, it included the AI Awareness Scale, comprising 36 phrases/clauses measuring the level of awareness of teachers towards AI and its educational applications. The phrases (questions) are matched with five responses defining their level of agreement (awareness) according to the Likert-type five-point scale, as follows: Strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, and strongly agree = 5. The questionnaire was then submitted to a panel of experts in this field for their review and was later pilot tested with a selection of in-service teachers from general education schools who were not part of the study's sample. The tool/scale was carefully evaluated by the experts with respect to its validity and reliability, and it achieved a 0.972 Cronbach's alpha (α) coefficient value (considered "excellent" in most social sciences and humanities studies). This exhibits a very high degree of internal consistency among the scale's items, making it suitable for study and scientific research purposes, instills full confidence in using the tool and initiating the data collection process (Abou-Allam, 2021; Creswell & Creswell, 2018; Healey, 2016; Levin et al., 2016).

Data Collection

The data were collected over a seven-month period (during the first and second semesters of the 2023/2024 school year) using an anonymous questionnaire that was administered through an online survey tool and distributed electronically to in-service teachers using various ICT media/platforms. The teachers were asked to voluntarily participate and complete the survey questionnaire. They were instructed to respond to the questionnaire phrases/statements (questions) truthfully and honestly. Participants were assured that their data would be kept confidential and would be used only for statistical analysis purposes.

Methods of Analysis

After conducting the study and completing the data collection process, the quantitative data were entered into Microsoft Excel, then imported into the IBM SPSS Statistics software (version 29) for statistical processing. Subsequently, statistical data, analyses, and necessary comparisons (study results) were extracted. Specifically, this research study required the use of the following statistical methods to explore and analyze the collected data:

(1) The descriptive statistics procedures applied were Cronbach's alpha, frequencies, percentages, means, standard deviations, and relative importance indexes (RIIs), also known as relative weights. Table 1 defines the statistical standard used to interpret sample estimates or responses to the AI awareness scale's items/phrases (Akadiri, 2011; Safar, 2020b).

Table 1. The statistical criterion for interpreting the participants' responses to the AI awareness questionnaire/scale according to the extent of the relative importance indexes (relative weights).

Relative Importance Indexes Range	Relative Weights Range	Awareness Degree/Extent
0.80 – 1.00	80.0 – 100.0	Very high/very large
0.60 – 0.79	60.0 – 79.0	High/large
0.40 – 0.59	40.0 – 59.0	Moderate/medium/average
0.20 – 0.39	20.0 – 39.0	Low
0.00 – 0.19	0.0 – 19.0	Very low

(2) The inferential statistics procedures used were a series of parametric comparisons/tests—such as independent-samples t-tests, one-way analyses of variance (ANOVAs), Dunnett's C multiple comparisons tests, and Scheffe's multiple comparisons tests—were also employed to assess the differences between/among the groups of teachers in terms of the following independent variables: gender, type of specialization, ICT qualification, AI training courses, ICT proficiency, and professional experience. These techniques met the basic parametric assumptions required for their implementation. An alpha (α) threshold of 0.05 was selected for the inferential tests.

Results and Discussion

First: Demographic Profile of the Respondents

Table 2 outlines the demographic profile of the participants, in-service teachers, according to demographic variables (independent variables).

Table 2. Participants' demographic information in frequencies and percentages.

Variable	Category	*N*	%
Gender	Male	456	23.7
	Female	1,468	76.3
Nationality	Kuwaiti (Citizen)	1,716	89.2
	Non-Kuwaiti (Resident)	208	10.8
Type of Specialization	Arts, humanities, & social sciences (AHSS) disciplines	1,284	66.7
	Scientific disciplines	640	33.3
Qualification	Bachelor	1,772	92.1
	Master/doctorate	152	7.9
Age	20 to < 30 years	1,048	54.5
	30 to < 40 years	576	29.9
	40 to < 50 years	204	10.6
	50 years and more	96	5.0
Professional Experience	0 to < 10 years	1,324	68.8
	10 to < 20 years	412	21.4
	20 years and more	188	9.8
Type of School	Public general education schools	1,840	95.6
	Private general education schools	84	4.4
Educational Area/District	Al-Ahmadi	480	24.9
	Al-Jahra	328	17.0
	Hawalli	348	18.1
	Al-Asema	188	9.8
	Al-Farwaniya	420	21.8
	Mubarak Al-Kabeer	160	8.3
Educational Stage	Kindergarten	324	16.8
	Primary	672	34.9
	Intermediate	432	22.5
	Secondary	496	25.8
ICT Proficiency	Low (beginner)	668	34.7
	Moderate (intermediate)	972	50.5
	High (expert/advanced)	284	14.8
International ICT Qualification Ownership	Does hold an international ICT certificate	516	26.8
	Does not have an international ICT certificate	1,408	73.2

AI Training Courses Attendance	Did attend training courses in AI	360	18.7
	Did not attend any training courses in AI	1,564	81.3

Second: Research Questions' Results

The Results for Research Question No. 1. Research question no. 1 was stated as follows: What is the level of awareness among teachers in general education schools in the State of Kuwait regarding AI and its educational applications in teaching and learning? The survey included 36 items (phrases/questions) addressing the overall teachers' degree/extent of awareness of AI and its uses in education. After the answers were submitted, a set of descriptive statistics procedures were used to analyze the data; these are comprehensively displayed in Table 3.

Table 3. Descriptive statistics of the in-service teachers' responses to the questions of the AI awareness questionnaire/scale.

No.	Phrase/Statement	*M*	*SD*	RII	Awareness Degree/Level	Rank
1	I am familiar with the concept and nature of AI.	4.01	0.86	0.80	Very high/large	
2	I know how machine learning, artificial neural networks, and AI algorithms work.	3.52	1.01	0.70	High/large	
3	I understand the philosophy of AI.	3.73	0.99	0.75	High/large	
4	I know the goals of AI.	3.84	0.94	0.77	High/large	
5	I am aware of the types of AI.	3.53	1.02	0.71	High/large	
6	I know the importance of AI in education (teaching and learning).	4.06	0.96	0.81	Very high/large	
7	I understand the different roles of AI in education.	3.88	0.98	0.78	High/large	
8	I am familiar with the uses of AI in education.	3.75	1.00	0.75	High/large	
9	I know the advantages of using AI in education.	3.92	0.95	0.78	High/large	
10	I am aware of the disadvantages of using AI in education.	3.90	1.01	0.78	High/large	
11	I am familiar with the principles and ethics of using AI in education.	3.84	1.01	0.77	High/large	
12	I have used AI applications in education.	3.60	1.15	0.72	High/large	
13	I understand how AI can contribute to the development of education.	3.99	0.97	0.80	Very high/large	
14	I know how AI can help improve the quality of education and enhance the teaching and learning experience.	4.02	0.92	0.80	Very high/large	
15	I understand how AI applications can explore new horizons for education.	4.01	0.92	0.80	Very high/large	
16	I am aware that AI has the potential to help teachers and learners.	4.06	0.91	0.81	Very high/large	
17	I know that AI applications can contribute to the development of critical thinking skills for learners.	4.00	0.89	0.80	Very high/large	

18	I understand that AI technologies can improve the customization of teaching and learning, and better meet the needs of both teachers and learners.	4.00	0.90	0.80	Very high/large
19	I am aware that the integration of technology and AI in teaching and learning is an important part of the future of education.	4.14	0.88	0.83	Very high/large
20	I am aware that there are opportunities to use AI-based applications to improve teaching and learning practices in my educational institution.	3.98	0.90	0.80	Very high/large
21	I know that AI applications can contribute to enhancing machine, personalized, adaptive, deep, and distance/remote (electronic, online, mobile, virtual) teaching and learning.	3.97	0.91	0.79	High/large
22	I know that there are technical, human, and financial requirements related to the use of smart applications in education.	4.07	0.88	0.81	Very high/large
23	I am aware that there are challenges or concerns related to the use of AI in education.	4.08	0.89	0.82	Very high/large
24	I recognize the ethical risks of AI uses in education.	4.02	0.94	0.80	Very high/large
25	I avoid the ethical risks of using smart applications in education.	4.02	0.96	0.80	Very high/large
26	I am keen on learning more about how to use technology and AI applications in education.	3.98	0.90	0.80	Very high/large
27	I have ideas or suggestions for improving the use of technology and AI in education.	3.58	1.03	0.72	High/large
28	I have experiences with using smart applications in education that I would like to share with the education community.	3.57	1.08	0.71	High/large
29	I have examples of how I personally benefited or how my students benefited from the use of AI applications in education.	3.55	1.09	0.71	High/large
30	I received training or support from my educational institution or employer regarding the use of AI and educational technology.	3.29	1.26	0.66	High/large
31	My educational institution provided the necessary resources and training to help me understand and use AI applications in education.	3.23	1.22	0.65	High/large
32	I occasionally raise awareness about AI applications in education.	3.59	1.10	0.72	High/large
33	I read informational awareness brochures about the concepts of AI, its ethics, applications, and risks.	3.67	1.04	0.73	High/large
34	I read the principles, ethics, policies, and procedures guide specific to AI and its uses in educational environments, and I make sure to adhere to its implementation.	3.65	1.06	0.73	High/large
35	I participate in training courses, workshops, and specialized seminars on how to use AI-based applications in education.	3.51	1.10	0.70	High/large

36	I pay attention to governmental and non-governmental efforts aimed at promoting AI and increasing its effectiveness.	3.75	0.98	0.75	High/large
	Overall Awareness Degree/Level of AI	3.81	0.71	0.76	High/large

From Table 3, it is evident that the level of awareness among teachers in general education schools in Kuwait regarding the applications of AI in education came generally at a "high/large" level (*M* = 3.81, *SD* = 0.71, RII = 0.76). The results showed that their level of awareness was "high/large" for the majority of the scale items (21 items), while the remaining scale items (15 items) scored "very high/large".

This result somewhat agrees in its essence with the findings of other research studies, such as the study by Safar (2024b), which concluded that the level of awareness among pre-service teachers at the College of Education, Kuwait University, regarding the applications of AI in education, generally came at a "high" level (*M* = 3.66, *SD* = 0.68, RII = 0.73). Similarly, the study by Samili (2023) showed that the degree of agreement among science teachers regarding the role of AI applications in enhancing their professional performance overall was "significant", indicating a "high" level of awareness and knowledge. Additionally, Abdulsalam's study (2021) revealed that the level of agreement among faculty members regarding the use of AI technologies and applications in the field of education overall was "significant", indicating a "high" level of awareness and understanding.

This is further supported by Abd-Elraheem and Hassanein's study (2022), which indicated that the degree of agreement among technology experts on the necessity of providing all necessary requirements for digital transformation in Egyptian higher education using AI applications, and on the challenges hindering their use overall, was "significant", suggesting a "high" level of awareness, understanding, and knowledge among experts. Likewise, Al Habib's study (2022) showed that the degree of agreement among faculty members at Saudi universities on the challenges hindering the use of AI technologies and applications in their training, development, and professional growth in an appropriate and effective manner overall agreed to a "significant" extent, indicating a "high" level of awareness, understanding, and knowledge on this subject.

However, this result of the current study differs from the findings of other scientific studies, such as the study by Shaban (2021), which indicated in its results that the level of awareness and understanding among faculty members and university students regarding the importance of using AI algorithms, technologies, and programs in the field of higher education overall was "weak", indicating their lack of conviction, acceptance, and weak desire to integrate and employ them in higher education for teaching and learning. In a similar fashion, the study by Al Kanaan (2022) showed that the level of awareness among pre-service science teachers towards the use of AI applications in science education overall was "low".

In addition, the study by Al-Saidi et al. (2023) revealed that the degree of integration of concepts and applications of AI in the curriculum content of social studies in the eleventh and twelfth grades in Oman was generally "weak/low", indicating a "low" level of awareness, understanding, and knowledge among teachers, students, and administrators in this regard. Therefore, the study recommended the necessity of developing curricula to include concepts and applications of AI, as well as the imperative of raising awareness among teachers and administrators about the importance of teaching and learning using AI algorithms, technologies, and software through training programs, workshops, seminars, and awareness lectures conducted by specialists.

Furthermore, Aloufe and Alrehaili's study (2021) revealed that the level of awareness and knowledge among secondary school mathematics teachers regarding AI and its potential for enhancing students' innovative abilities, as well as the importance of using smart technologies in education overall, was "moderate". Similarly, the study by Alghamdi and Alfarani (2020) indicated that the level of knowledge and skills related to the use of AI technologies and applications in teaching and learning among special education teachers at the Noor Institute in Jeddah, Saudi Arabia, was generally "moderate/neutral". Also, the study by Ferikoğlu and Akgün (2022) revealed that the level of awareness of AI and its applications in education among Turkish teachers in public and private schools overall was "moderate".

Moreover, Al Habib's study (2022) showed that the degree of agreement among education experts regarding the current status of employing AI technologies and applications in training university faculty

members in Saudi universities overall was “moderate”, indicating a “low to moderate” level of awareness, understanding, and knowledge among them. As well, Abd-Elraheem and Hassanein’s study (2022) revealed that the level of agreement among higher education experts in Egypt regarding the current status of using AI technologies and applications by faculty members in Egyptian universities in higher education teaching and learning overall was “moderate”, suggesting a “weak to moderate” level of awareness, understanding, and knowledge. Similarly, Ramadan’s study (2021) showed that secondary school teachers in Saudi Arabia use AI applications in education to a “moderate” degree, indicating a “weak to moderate” level of awareness, understanding, and knowledge in this regard.

The Results for Research Question No. 2. Research question no. 2 was stated as follows: Are there statistically significant differences in the opinions of teachers in general education schools in the State of Kuwait and their perceptions regarding their awareness level of AI and its educational uses in teaching and learning that can be attributed to gender, type of specialization, ICT qualification, AI training courses, ICT proficiency, and professional experience? In this study, several inferential statistics tests were applied to determine whether there were any significant differences among the in-service teachers’ responses to the questionnaire/scale (see Tables 4-5). Generally, the results indicate that the sociodemographic profile of the teachers did indeed influence the overall degree/level of awareness of AI among them.

Table 4. The inferential statistics of the differences in the in-service teachers’ responses to the phrases/questions of the AI awareness questionnaire/scale by gender, type of specialization, ICT qualification, and AI training courses variables.

No.	Independent Variable	Category	*N*	*M*	Std. Deviation	*t*	*df*	Sig. (2-tailed)
1	Gender	Male	456	3.72	0.82	-3.376	1,922	0.001*
		Female	1,468	3.84	0.66			
2	Type of specialization	AHSS/literary	1,284	3.81	0.70	-0.575	1,922	0.566
		Scientific	640	3.83	0.72			
3	ICT qualification	Does hold an ICT certificate	516	3.96	0.74	5.673	1,922	0.000*
		Does not have an ICT certificate	1,408	3.76	0.69			
4	AI training courses attendance	Did attend AI training courses	360	4.31	0.58	15.565	1,922	0.000*
		Did not attend AI training courses	1,564	3.70	0.68			

*Note. * = The mean difference is significant at the 0.01 level ($\alpha \leq 0.01$).*

Table 4 shows that there are statistically significant differences at the significance level of 0.01 between the means of responses of male and female teachers in Kuwait's general education schools—in favor of the female category—regarding their opinions and perceptions (attitudes) about their awareness level of AI and its educational uses in teaching and learning in the research's tool/scale as a whole.

This result can be interpreted in the statistical context and attributed to the larger sample size of female participants (1,468 participants, 76.3%) compared to the number of male participants (456 participants, 23.7%). The reason for this primarily stems from the fact that the number of female teachers in general education schools under the Ministry of Education is much higher than the number of male teachers (67,077 female teachers and 21,908 male teachers, according to the Ministry of Education statistics for the 2022/2023 academic year) (Central Statistical Bureau, 2023). Additionally, this result can be justified by the fact that female teachers are more eager and enthusiastic to develop and enrich their abilities and their personal and professional knowledge in the field of ICT. Therefore, they are more passionate, eager, inclined, and skilled than male teachers in exploring and learning about everything new in the field of ICT and its various branches; thus, they practice the use and integration of ICT tools in their personal as well as professional lives more often than their male peers. Also, female teachers in general education

schools may exhibit higher academic and professional competence, rooted in their solid foundation, when viewed through the socio-cultural lens. This could be attributed to their concerted efforts to demonstrate competence and vie with their male counterparts. Moreover, female teachers in such environments might display greater seriousness, focus, and enthusiasm towards teaching and learning, in contrast to their male counterparts. Perhaps this is the reason for the statistically significant difference in the opinions and perceptions (attitudes) of the two groups.

This result is consistent in its essence with the result reached by Al-Atel et al. (2021), which indicated statistically significant differences in the responses (opinions and perceptions) of students in the College of Basic Education in Kuwait regarding the challenges or obstacles facing the use of AI technologies and applications in education according to the gender variable, favoring females. It also aligns with the findings of Alfarani and Alhujaili (2020), which revealed statistically significant differences in the responses of the study sample of teachers regarding the intention to use AI technologies and applications in education attributed to the gender variable, favoring female teachers. However, it differed at the same time from the result of Safar's study (2024b), which indicated statistically significant differences in the opinions of pre-service teachers in the College of Education at Kuwait University and their perceptions regarding their awareness level of AI and its educational uses in teaching and learning, attributed to the gender variable, favoring males. As well, Ramadan's study (2021) which disclosed no statistically significant differences in Saudi Arabia secondary school teachers' perceptions regarding the use of AI applications in education based on gender variable.

Table 4 also shows that the tests of differences between the participating groups indicated no statistically significant differences at the 0.05 significance level between the means of responses of teachers in general education schools in Kuwait regarding their opinions and perceptions (attitudes) about their awareness of AI and its educational applications in teaching and learning, attributed to the variable of specialization type (AHSS/literary, scientific), in the research's tool/scale as a whole. This result can be justified by the fact that AI and its algorithms, technologies, and applications in the field of education is a vital topic that concerns all individuals regardless of their specialization. Therefore, we find that awareness and knowledge of this topic are of

interest and priority for everyone, perhaps this is the reason for the complete agreement and harmony in the opinions and perceptions (attitudes) of both groups.

A number of earlier research studies have shown similar results to this study, such as the result reached by the study of Safar (2024b), which confirmed the absence of statistically significant differences in the opinions of pre-service teachers at the College of Education at Kuwait University and their perceptions of their awareness level of AI and its educational uses in teaching and learning, which can be attributed to the variable of specialization type. It also agrees with the result of the study by Alfarani and Alhujaili (2020), which indicated that there are no statistically significant differences between the means of estimates of teachers regarding the determination of the intention to use AI in education, attributed to the type of specialization variable.

As evident from Table 4, statistically significant differences at the 0.01 significance level exist between the means of the estimations of teachers in general education schools in Kuwait regarding their opinions and perceptions (attitudes) about their awareness of AI and its technologies, applications, and utilization in education, attributed to the ICT qualification variable (holds an ICT certificate, does not have any ICT certificate). This difference is evident across the research's tool/scale, favoring those with any international certificate in the field of ICT. This result can be justified by the fact that teachers holding international certificates in the field of ICT possess a higher level of awareness, familiarity, and knowledge regarding all aspects of ICT tools and applications in education, including the subject of AI, compared to their peers who do not have any international certificate in the field of ICT.

This result of the current study differs from those of other studies, such as the study by Safar (2024b), which indicated no statistically significant differences at the 0.05 significance level between the means of estimations of pre-service teachers in the College of Education at Kuwait University regarding their opinions and perceptions (attitudes) about their awareness of AI and its technologies, applications, and utilization in education, attributed to the ICT qualification variable. However, it somewhat aligns with the result of Aloufe and Alrehaili's study (2021), which confirmed the presence of statistically significant differences in the opinions of secondary school teachers in Saudi Arabia regarding the level

of knowledge and importance of using AI applications. These differences were associated with the level of technical skills, favoring teachers with high technical skills.

Table 4 also reveals statistically significant differences at the significance level of 0.01 between the means of responses of teachers in general education schools in Kuwait regarding their opinions and perceptions (attitudes) towards their awareness of AI and its applications in the field of education, attributed to the variable of AI training courses attendance (attended, not attended), in the research's tool/scale as a whole and in favor of teachers who have participated in previous training courses in the field of AI. This result can be interpreted logically in the context that participants who engaged in previous training courses specializing in AI had a high level of awareness, understanding, knowledge, and familiarity with this core subject compared to their peers who did not attend any training course. Additionally, the previous result can be explained statistically due to the small sample size of participating teachers who had prior training courses in AI, numbering 360 teachers (about 18.7%), compared to the number of participants from the category of teachers who did not engage in any training course in the field of AI, which amounted to 1,564 teachers (about 81.3%). Perhaps this is the reason for the statistically significant differences in the means of participants' responses according to the variable of AI training courses in favor of those who received training courses.

This result aligns in its content with the result of Safar's study (2024b) which revealed statistically significant differences at the significance level of 0.01 between the means of responses of pre-service teachers at the College of Education at Kuwait University regarding their opinions and perceptions (attitudes) towards their awareness of AI and its applications in the field of education, attributed to the variable of AI training courses attendance (attended, not attended), in the research's tool/scale as a whole and in favor of pre-service teachers who had participated in previous training courses in the field of AI. However, it contradicts in its essence with the result of the study by Aloufe and Alrehaili (2021) which confirmed the absence of statistically significant differences between the means of responses of high school mathematics teachers regarding their level of knowledge about the possibility of employing AI applications in teaching the mathematics curriculum to

develop the innovative abilities of high school female students, and the importance of their use of these smart applications attributed to the variable of the number of training courses in the field of technology. Likewise, Ramadan's study (2021) which revealed that there were no statistically significant variances in the perceptions of secondary school teachers in Saudi Arabia concerning the utilization of AI applications in education based on their participation in AI courses.

Table 5. The inferential statistics of the differences in the in-service teachers' responses to the phrases/questions of the AI awareness questionnaire/scale by ICT proficiency and years of professional experience variables.

No.	Independent Variable	Source of Discrepancy	Sum of Squares	*df*	Mean Square	*F*	Sig.
1	ICT proficiency	Between groups	57.623	2	28.811	61.477	0.000*
		Within groups	900.280	1,921	0.469		
		Total	957.903	1,923			
2	Professional experience	Between groups	6.984	2	3.492	7.055	0.001*
		Within groups	950.918	1,921	0.495		
		Total	957.903	1,923			

*Note. * = The mean difference is significant at the 0.01 level (α ≤ 0.01).*

From Table 5, statistically significant differences at the 0.01 level of significance are evident among the means of responses from teachers in general education schools in Kuwait regarding their opinions and perceptions (attitudes) towards their awareness of AI and its applications in education. These differences are attributed to the variable of ICT proficiency level (low/beginner, moderate/intermediate, high/expert/advanced) in the overall research's instrument/scale. Specifically, the results of pairwise post-hoc comparisons revealed differences found between three pairwise groups: (low/beginner, moderate/intermediate), (low/beginner, high/expert/advanced), and (moderate/intermediate, high/expert/advanced); always in favor of the participants with the highest ICT proficiency level. This may be attributed to the fact that participants in this group are the most aware, passionate,

inclined, desirous, informed, skilled, knowledgeable, interested, motivated, and supportive of the adoption of new ICT tools, services, and applications—including AI algorithms, technologies, and applications—in the field of education, compared to the other group. This positively affects their level of awareness, understanding, familiarity, and knowledge of smart technologies and how to employ them in education as teaching and learning tools, compared to the other group.

This result aligns with findings from other scientific research studies, such as the study by Safar (2024b), which showed statistically significant differences at the 0.05 significance level between the mean responses of pre-service teachers at the College of Education, Kuwait University, regarding their opinions and perceptions (attitudes) towards their awareness of AI and its applications in education. These differences were attributed to the variable of ICT proficiency level (beginner, proficient/intermediate, expert/advanced) in the research's tool/scale as a whole. Specifically, the results of post-hoc comparisons revealed differences between only one pair, which is (beginner, proficient/intermediate), in favor of the group with higher ICT proficiency level (proficient/intermediate). Similarly, it agrees with the study by Aloufe and Alrehaili (2021), which revealed statistically significant differences between the mean responses of the secondary school mathematics teachers regarding their level of knowledge about the potential use of AI applications in teaching the mathematics curriculum to enhance the innovative abilities of secondary school female students. The importance of their use of these smart applications was attributed to the variable of technical skills level, favoring teachers with a "high" level of technical skills. Also, Safar's study (2020a) confirmed the presence of statistically significant differences in the estimations of the study sample consisting of male and female students at Kuwait University in all seven components of the Information and Communication Technology Acceptance Model (ICTAM) regarding their awareness of e-books, their actual usage, perceptions towards them, and satisfaction levels. These differences were attributed to the variable of ICT proficiency level, with the advantages consistently favoring individuals in the "highest" ICT proficiency category.

On the other hand, the results of the current study also contradicted findings from other studies, such as the study by Aloufe and Alrehaili

(2021), which showed no statistically significant differences between the mean estimations of secondary school mathematics teachers regarding the identification of barriers to using AI applications in developing innovative abilities of students, attributed to the variable of technological skills level. Additionally, the results of the current study conflicted with the study by Jazeel (2018), which revealed statistically significant differences between the responses of pre-service teachers at a government teacher training college in Sri Lanka regarding their awareness of cybersecurity, attributed to the variable of computer knowledge level, favoring those with no knowledge.

The results of the analysis shown in Table 5 also revealed that there are statistically significant differences at the 0.01 level of significance in the average responses of the study's sample with regard to their opinions and perceptions (attitudes) towards their awareness of AI and its applications in education. These differences are attributed to the variable of years of professional experience (0 to < 10 years, 10 to < 20 years, 20 years and more) in the study's tool/scale as a whole. Specifically, the findings of post-hoc comparisons revealed differences found in only one pair, namely (0 to < 10 years, 20 years and more), in favor of participants with higher years of professional experience (20 years and more).

This may be attributed to the fact that participants from this category of teachers are referred to as "Digital Natives", as they have grown up using digital technology tools throughout their personal and professional lives. Therefore, based on their extensive professional experience over the past two decades, they fully realize the educational benefits they will reap through the integration and deployment/use of algorithms, technologies, and applications of AI in the educational field. This can also be attributed to the fact that participants in this group are the most aware, passionate, inclined, desirous, informed, skilled, knowledgeable, interested, motivated, and supportive of the adoption of new ICT tools, services, and applications—including AI algorithms, technologies, and applications—in the field of education, compared to the other groups. Thus, this positively impacts their level of awareness, understanding, familiarity, and knowledge of smart technologies and how to employ them in education as teaching and learning tools, compared to the other groups. The interpretation of this result from a statistical perspective can be attributed to the small size of the participating sample

of teachers in general education schools in the category with highest years of professional experience (20 years and more), which amounted to 188 participants (approximately 9.8%), in comparison to the participating sample with the lowest years of teaching experience (0 to < 10 years) who were 1324 participants (about 68.8%), which is almost six times larger.

On the contrary, the findings of several previous research studies showed different results to the current study, such as the study of Samili (2023), the study by Aloufe and Alrehaili (2021), as well as Ramadan's study (2021), which all confirmed that there are no statistically significant differences between the participants' overall responses or perceptions due to the variability of professional experience.

Conclusion and Recommendations

In conclusion, the use of AI technologies and applications in the field of education demonstrates a revolutionary potential to enhance the quality and efficiency of the teaching and learning processes. It opens the doors to a unique educational experience, offering innovative and creative teaching and learning methods that emphasize personalized education, stimulate competition, increase participation and interaction, enable accurate assessment, enhance performance, address challenges (problem-solving), and make educational activities more engaging and enjoyable. In this way, AI contributes to creating an innovative and stimulating educational future that can better serve individuals and communities in this digital knowledge age.

Based on the results obtained in the current study, the researcher recommends the following:

1. Raising awareness about AI culture and promoting optimal use and benefit of its intelligent technologies and applications in the field of education among educational staff, thereby creating an educated and conscious generation.
2. Providing continuous training courses, workshops, seminars, discussion sessions, and specialized lectures—by hosting prominent experts in the field—aimed at educating teachers on how to use AI-based applications in teaching and learning, and how to maximize their benefits.

3. Developing and distributing informative brochures, posters, and pamphlets introducing the concepts of AI, its ethics, applications, and risks, through both traditional methods and social media platforms.
4. Establishing an interactive digital educational guidebook on the principles, ethics, policies, and procedures related to AI and its uses in educational environments and ensuring compliance with its implementation.
5. Integrating the topic of AI and its utilization in the field of education—including its technologies, algorithms, and applications—into professional academic programs designed for teacher preparation and development.
6. Increasing efforts, guidance, and support from governmental and non-governmental educational entities aimed at enhancing the use of technology and AI applications in education, and effectively benefiting from them.
7. Supporting comprehensive strategic partnerships across sectors and stakeholders to integrate and utilize AI technologies and applications in educational environments.
8. Strengthening international, regional, Gulf, and local cooperation to facilitate and ensure comprehensive access to AI technologies, software, and emerging digital innovations. This includes leveraging the experiences and expertise of others in this vital field.
9. Encouraging development and innovations in algorithms, technologies, applications, and tools of AI to enhance the outcomes and outputs of education in all contexts.
10. Honoring individuals, institutions, bodies, and organizations who innovate new approaches and undertake distinctive projects utilizing modern technologies and AI applications to advance the processes of teaching and learning in the digital knowledge age. These modern technologies and smart applications help expand the scope of educational and learning opportunities, ensuring that everyone benefits from high-quality education and providing sustainable lifelong learning opportunities. This initiative will highlight pioneering and exemplary models, identify best practices, and explore ways to

creatively integrate and use ICT tools, as well as modern smart technologies and applications, to comprehensively enhance academic educational performance.

11. Ministries of education and educational institutions endeavor to include the subject of AI in its various aspects within their curricula in schools, institutes, colleges, and universities. This includes introducing subjects such as robotics, AI, its technologies, and various smart applications in classrooms across different educational stages to train and equip learners on how to interact with, engineer, and effectively utilize them in their teaching and learning.
12. Encouraging ministries, educational institutions, bodies, and organizations to establish activities, competitions, and educational festivals at local, Gulf, regional, and international levels focusing on various AI technologies and applications in the education sector (teaching and learning). These may include robotics, algorithms, and smart software, wherein various educational institutions—both governmental and private, civil society organizations, scientific and research institutions, as well as individuals such as learners, teachers, administrators, technical supervisors, parents, academics, researchers, educators, and specialists in the field—can effectively participate and compete. This initiative aims to highlight pioneering and distinguished models, identify best practices, and explore innovative ways to integrate and use ICT tools, as well as modern smart technologies and applications, to comprehensively enhance academic educational performance.
13. The necessity of having an ethical code, laws, policies, regulations, and legislation for legal accountability regarding the use of algorithms, technologies, and applications of AI, particularly after the emergence of ethical threats and risks following the use of such technologies and smart programs.
14. Developing the technical infrastructure and educational environment of educational institutions to interact with algorithms, technologies, and applications of AI, and providing all necessary needs and requirements to ensure their effective

integration and utilization in the field of education—both basic and higher education.

15. The importance of developing educational policies, procedures, and practices in educational institutions to enhance the integration and use of algorithms, technologies, and applications of AI in the teaching and learning processes, and to interact with them effectively and optimally according to the basic guidelines issued by relevant authorities, institutions, and organizations specialized in AI.
16. Promoting coordination, cooperation, and partnership between educational institutions and bodies, and organizations specialized in AI to enhance awareness in the field of AI.
17. Conducting more similar research studies using different samples, variables, and methodologies, and on different communities. Additionally, conducting experimental studies to demonstrate the effectiveness (impact) of educational programs based on the use of AI technologies and software.

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