A systematic review of artificial intelligence in education in the arab world

مراجعة أدبية للذكاء الاصطناعي في التعليم في العالم العربي

Written by:
Abdulaziz Alzahrani[113]
https://orcid.org/0000-0001-8538-5058

Abstract

In recent years, many technological innovations that have contributed to the success of the educational process, and artificial intelligence is one of these recent innovations. Artificial intelligence has become one of the technological tools used in education and demonstrated a successful emergency strategy during the pandemic of Covid-19. This study aimed to focus on the role artificial intelligence played in education in Arabs world during the last five years. This study conducted a comprehensive survey of the research published in three databases (Google Scholar, ERIC, and IEEE) to reach the goal of this study. The total number were found in three databases was 436 and 29 of them are related to "Artificial Intelligence and Learning and Teaching and Arab world", the abstracts of these studies were checked according to adopted methodology. The methodology was applied to select the studies is where these studies applied, the specialization of the researcher, and the research methodology followed. Moreover, the goals of the selected papers, the results, and similarities and differences among these studies were discussed. Recommendations and future studies also discussed.

Keywords: Artificial intelligence, Learning, Teaching, Arab world.

الملخص

في السنوات الأخيرة، ظهر العديد من الابتكارات التكنولوجية التي ساهمت في نجاح العملية التعليمية، ويعد الذكاء الاصطناعي هو أحد هذه الابتكارات الحديثة التي استخدمت في التعليم خلال جائحة كورونا (Covid-19). ومن هذا المنطلق، هدفت هذه الدراسة إلى معرفة دور الذكاء الاصطناعي في التعليم وخصوصا في العالم العربي خلال السنوات الخمس الماضية. ولتحقيق هدف الدراسة، تم الاستقصاء عن الدراسات التي بحثت في الذكاء الاصطناعي في ثلاثة قواعد بيانات (Google Scholar, ERIC, IEEE)، وبلغ مجموع الدراسات المتعلقة بالذكاء الاصطناعي في العالم العربي 436 دراسة. خضعت هذه الدراسات إلى فحص الملخصات، وكان عدد الدراسات التي تتوافق مع هدف الدراسة الحالية هو 29 دراسة. تناولت هذه الدراسة عدة محاور وهي أهداف الدراسات المختارة، تخصص الباحث الأول، منهجية الدراسات المختارة. ناقشت هذه الدراسة أيضاً نتائج الدراسات في الذكاء الاصطناعي وأوجه الاختلاف والتشابه بينها، وتضمنت عدة توصيات ودراسات مستقبلية.

الكلمات المفتاحية: الذكاء الاصطناعي، التدريس، التعليم، العالم العربي.

Introduction

Innovation is vital to societal well-being and the fostering of economic progress. The world has witnessed and continues to witness the integration of many cutting-edge technologies in the market, which is shaping business strategies (Alastal et al., 2021). New innovative technologies and the revolution of fourth-generation (4G) technologies have made dramatic changes in the world, while also posing many challenges in different fields that require

---

[113] Associate Professor of Instructional Technology College of Education, University of Ha'il Saudi Arabia.

integrated systems and a flexible qualifications framework (Alraasibia, 2021). The labor sector is expected to witness changes in professions—the disappearance of some, and the emergence of new professions that depend on the technologies of this revolution (Alraasibia, 2021). Technology has become an indispensable element in all areas of life (Alastal et al., 2021). Several systems, as well as their processes, have undergone major changes. Aside from that, the 4G revolution has resulted in new types of jobs and skills in the technology field that are distinct and advanced (Fouda, 2020). According to Haneya et al. (2021), individuals can easily interact with one another and facilitate workflows using various communication tools provided by technology. Tools like Skype, WhatsApp, and others are becoming more and more popular and are highly utilized by individuals within all societies (Haneya et al., 2021).

From the end of the past century to the present, the programmers' focus has been on creating and developing algorithms and methodologies that may be used to gain an advantage in machine learning (Alastal et al., 2021). Researchers were able to construct computers capable of generating judgments based on answers to pre-programmed issues in the mid-1980s, but those programmers failed to use their discovery for practical applications at the time (Alastal et al., 2021). Since the beginning of the human relationship with electronic computers, program developers' thinking has turned to training these computers to practice many skills of human nature. Researchers have sought to develop new scientific theories and develop techniques based on them with the aim of making computers perform the work that humans do, but in a better way (Abuzakiyeh, 2018). This science is known as artificial intelligence, and the techniques it uses depend on defining the concept of human intelligence and then linking it to the computer's capability to perform (Abuzakiyeh, 2018).

For today's nations, progress is measured not by the amount of information that a country possesses, but by its ability to organize and use that information to help the human race. In fact, the most developed countries in the field of informatics have become the most economically and financially powerful (Alastal et al., 2021). As we move into the fifth generation of the 5G Internet, or what is called the "internet of things," the world's electronic devices will increasingly be interconnected through known Internet protocols, resulting in computerized objects surrounding us everywhere (Alastal et al., 2021). Therefore, an integrated approach is required that

designs solutions for each country or region to address some of the challenges identified in assimilating new technologies within systems and processes to achieve the best results (Sourani, 2019).

The purpose of this paper is to present a literature review on the concept of AI in the Arab world and how the researchers integrate AI into their institutions as new technology. Integrating new technology is considered an important tool in the education sector to improve the students' learning (Elayyan, 2021; Fouda, 2020). In addition, this paper explores the goal and results of the selected papers. There are many research studies, presented at different conferences, requesting that the use of AI be required in the Arab world to get the benefit of AI in the process of learning (Mawad, 2019; Mira & Katie, 2019; Mohammed, et al, 2021). Moreover, many ministries of education provided seminaries with information about AI to encourage the leaders of schools and the presidents of universities to use AI in their institutions (Johnson et al., 2022). This paper sheds light on Arab research in the field of AI. It presents a panoramic view of the implementation of AI in Arab countries. The systematic integration of AI into education will enable countries to address some of the biggest challenges in education today, innovate teaching and learning practices, and ultimately accelerate progress toward development and sustainability goals (Ghazi, 2021). It is important to note that artificial intelligence must not completely replace teachers; rather, the human mind should work side by side with the artificial mind in a calculated way.

Theoretical Framework or Literature Review

Artificial Intelligence advantages and disadvantages

Introduced by Alan Turing in the 1950s, Artificial Intelligence (AI) is a branch of computer science that attempts to mimic the human mind's ability to learn and make decisions (Haneya et al., 2021). Artificial intelligence systems aim to build systems that are intelligent and capable of learning—possessing the ability to create specialized knowledge and discover new phenomena (Abuzakiyeh, 2018).

Artificial intelligence and machine learning (ML) are among the newest innovative technologies that have changed business processes and replaced large portions of the decision-making process traditionally performed by humans (Haneya et al., 2021). As with any

new change, the utilization of artificial intelligence has many advantages as well as disadvantages. When it comes to the advantages, artificial intelligence can make up for a general lack of personnel, including specialized workers, within a particular field (Ghazi, 2021). For example, artificial intelligence has contributed to teaching and evaluating karate skills for students (Ghazi, 2021). In addition, artificial intelligence systems can be utilized to illustrate the differences between traditional methods and smart teaching methods in the field of education and learning (Abuzakiyeh, 2018). Moreover, artificial intelligence has become a tool for battling COVID-19 as the epidemic continues to affect people and businesses. With increased isolation restrictions and social restrictions by governments, communication and social interactions became challenging and extremely limited (Haneya et al., 2021). According to Haneya et al. (2021), when artificial intelligence was applied to medical departments, it offered many advantages, such as faster detection and reporting of patients' medical images and faster diagnosis by medical specialists. In addition, using information from multiple sources such as radiology, laboratory tests, and clinical examinations to deliver desired outcomes can be achieved using artificial intelligence (Haneya et al., 2021). Moreover, artificial intelligence has a growing role in telehealth, such as supporting the remote monitoring of patients by virtual doctors and improving overall patient experience (Haneya et al., 2021). Therefore, the application of artificial intelligence is considered an effective tool in slowing down and preventing the spread of COVID-19 and other infectious diseases.

As for the disadvantages, there is a high overall cost associated with creating a machine that can simulate human intelligence and frequently update it; therefore, not every country can afford it (Sourani, 2019) and (Mahmoud, 2020). Another disadvantage reported by faculty members is that the activation of artificial intelligence within a system can raise many obstacles (Mohammed et al., 2021). According to Mohammed et al. (2021), obstacles related to issues like scarcity of resources available to finance, lack of interest of college administrations, lack of knowledge of successful experiences in the field, and lack of studies dealing with artificial intelligence applications must be discussed and solved before transitioning to artificial intelligence. In addition, Aldossary et al. (2020) reported that "conducting educational research during the covid pandemic is confronted with scientific, administrative, psychological, health, and

technological challenges." Regardless of these shortcomings, it has been clearly shown that AI has advantages that outweigh its disadvantages, and its use is essential for the future.

Information and communication technology (ICT) is recognized as a core science used in education and one of the fundamental elements of modern society. In recent years, artificial intelligence algorithms and systems have gained popularity and become one of the most prominent technology applications, especially in education (Makhlouf, 2021). Internet-based learning has become a frequent part of the learning process, and tablets have largely replaced books in many educational facilities (Ghazi, 2021). Fouda (2020) explained that digital tools have made learning more active and independent, and they have revolutionized education. The manner of communication has also changed as a result of new technologies, so teachers must find new ways to motivate students and cope with this new era (Haneya et al., 2021).

Integrated education must adapt to the profound changes imposed by the Fourth Industrial Revolution, which is one of the most important global challenges facing teaching and learning today (Alraasibia, 2021). In the past, education systems, teachers, and students have faced many challenges with traditional classrooms. For example, Makhlouf (2021) explained that the lack of interaction and poor speaking practices of some teachers prevented traditional lessons from meeting the needs of learners in terms of enhancing their speaking abilities. However, this problem can be solved—both learning and teaching skills can be enhanced when AI is utilized within an educational system (Makhlouf, 2021). In response to the COVID-19 pandemic, a number of schools have closed, making online education more common. This has caused numerous challenges in the education sector. However, new opportunities for teacher assessment and professional development have arisen from ground-breaking applications of technology and educational information (Al-Zyoud, 2020). Education policymakers and governments have found that using technology as a teaching tool is the best approach at this time (Makhlouf, 2021). Using AI applications that provide accurate assessments and updated features can assist teachers as they develop students' skills and communicate information to them (Makhlouf, 2021).

AI can open new horizons in curricula, teaching strategies, and educational technologies for all fields of knowledge (Mahmoud, 2020). The

utilization of AI within the educational sector has been the focus of many studies in various fields and aspects of education. For example, Mohammed et al. (2021) used artificial intelligence techniques in developing teacher preparation programs. Another study by Al-Zyoud (2020) emphasized the role artificial intelligence plays in enhancing teachers' professional development. Furthermore, by developing an Artificial Intelligence (AI)-based model, the University College of Science and Technology was able to measurably improve its programming skills (Alastal et al., 2021). Another experimental study by Makhlouf (2021) showed how the application of artificial intelligence techniques improved students' learning skills.

Artificial Intelligence in the education sector in the Arab world

A number of Arabic countries, including Saudi Arabia, UAE, Libya, Oman, Lebanon, Palestine, and Egypt, have started researching and utilizing Artificial Intelligence within their systems and processes (Haneya et al., 2021). However, Sourani (2019) emphasized that Artificial Intelligence remains unprepared to substitute for teachers because of the various challenges presented in Arabic countries. It is also important to note that the challenges faced by Arabic countries may vary from the challenges faced by western and other countries (Sourani, 2019).

Upon reviewing the current literature, studies from countries that have unstable conditions, such as Libya, Iraq, Palestine, and Lebanon, focused on introducing artificial intelligence techniques, their role in smart teaching systems, and the perception of teachers on the utilization of artificial intelligence rather than on artificial intelligence applications themselves. For example, the role of artificial intelligence techniques was discussed in smart teaching systems to support their utilization in Libya (Abuzakiyeh, 2018). Another study in Libya dealt with the possibilities afforded by the domains of artificial intelligence and their use to the best advantage for both students and professors (Hussin et al., 2021). Furthermore, a study in Iraq discussed and defined the applications of artificial intelligence in education from the point of view of university teachers (Mira & Katie, 2019). The reason for choosing these subjects can be explained by war and unstable conditions in these countries, which contributed to the fact that people still lack access to computers and the Internet. This was even more evident with the closure of schools and

universities during the COVID-19 pandemic (Mahmoud, 2020). Building artificial intelligence and integrating it with systems requires accessible resources and strong research funding, which was not sufficient in these countries (Mahmoud, 2020). On the other hand, more extensive utilization and research on Artificial Intelligence can be observed in wealthier, more developed, and more stable Arabic countries like Saudi Arabia, UAE, and Egypt (Alhashmi et al., 2021; Johnson et al., 2022, Yanes et al., 2020). In Saudi Arabia, Yanes et al. (2020) proposed a machine learning-based recommender system to predict suitable actions for teachers and prevent undesirable and inappropriate decisions from occurring. In addition, Alhashmi et al. (2021) employed a humanoid robot as a teacher assistant in UAE classrooms to explore its effectiveness in assessing both the teachers and the students. Another study by Johnson et al. (2022) created an Artificial Intelligence learning course to teach students how to incorporate the technology into existing business processes. In Egypt, Artificial Intelligence was utilized in karate training and was found to be useful in the efficient assessment and evaluation of specific karate skills performed by students.

Methodology

The study followed the literature review research process, and the data was collected by retrieving research papers from three credible online databases (IEEE, ERIC, and Google Scholar). The chosen studies were conducted and published between January 2018 and July 2022. The selected studies in this paper were chosen by entering variations of the keyphrase "artificial intelligence and teaching and learning in the Arab world" into the search engines of the three databases. The total number of studies found in these three databases was 436; all abstracts were reviewed to ensure that the studies were relevant to the purpose of this paper. The final selection of reviewed studies from the three databases consisted of 29 papers. Table 1 shows the general summary of the selected studies. The highest number of studies were conducted in the Kingdom of Saudi Arabia (12 studies, or 41.38%), and six papers were conducted in the United Arab Emirates (6, 20.69%). Four papers were conducted in Egypt (13.79%), and two others in Libya and Oman (6.90%). Lastly, one paper each was applied in Palestine, Iraq, and Lebanon (3.45%). According to the authors' affiliation, Table (1) shows that most authors are from the College of Education (14, 48%), then the College of Computer of Science (3, or

10.34%). Three authors did not mention their college in the papers. Moreover, there were two authors who are from the College of Arabic Language, the College of English Language, and the College of Engineering (6.90%). One author was from the College of Science (3.45%), one

author was from the College of Business (3.45%), and one author was from the College of Media (3.45%).

Results and Discussion

Table 1.
General summary of the selected studies.

#	Author/ Authors	Affiliation of the first author	Country
1	Abalkheel, 2022	English Language and Translation	KSA
2	Abdeen, 2021	Special Education	KSA
3	Abdel Baky, 2022	Education Technology	KSA
4	Abuzakiyeh, 2018	Science	Libya
5	Alastal, et al, 2021	Curricula and methods of teaching educational technology	Palestine
6	Albasalah, et al, 2021	Arabic Language Department	KSA
7	Aldossary, et al, 2020	Educational Foundations	KSA
8	Alhashmi, et al, 2021	Education	UAE
9	Alnaqbi, 2020	Technology Management	UAE
10	Alraasibia, 2021	Education	Oman
11	Al-Zyoud, 2020	Education	UAE
12	Elayyan, 2021	NONE	Oman
13	El-hajj, 2019	Computer Science	UAE
14	Fouda, 2020	Agriculture Engineering	Egypt
15	Ghazi, 2021	Educational Sport	Egypt
16	Haneya et al, 2021	Computer Science	UAE
17	Hussin, et al, 2021	NONE	Libya
18	Jabli & Alqahtani, 2022	Instructional Technology	KSA
19	Johnson et al, 2022	Informatics and Media	UAE
20	Keezhatta, 2019	English	KSA
21	Mahmoud, 2020	Curricula and methods of teaching Arabic and Islamic education	Egypt
22	Makhlouf, 2021	English Language	KSA
23	Mawad et al, 2019	Educational Technology and Information	KSA
24	Mira & Katie, 2019	NONE	Iraq
25	Mohammed, et al, 2021	Basic Education	KSA
26	Nagro, 2021	Computer Science	KSA
27	Nasif, 2021	Interior Design	Egypt
28	Sourani, 2019	Linguistics and Educational Technology	Lebanon
29	Yanes et al, 2020	Computer and Information Sciences	KSA

Source (own author)

Finding

Table 2 shows eighteen papers (62.07%) that used a quantitative method (Abdel Baky, 2022; Abdeen, 2021; Alastal et al., 2021; Alhashmi et al., 2021; Al-Zyoud, 2020; Elayyan, 2021; Fouda, 2020; Ghazi, 2021; Hussin et al., 2021; Jabli & Alqahtani, 2022; Mahmoud, 2020; Makhlouf, 2021; Mawad, 2019; Mirat & Katie,

2019; Mohammed et al., 2021; Nagro, 2021; Nasif, 2021; Yanes et al., 2020). Ten papers (34.48%) used a qualitative method (Abalkheel, 2022; Abuzakiyeh, 2018; Albasalah et al., 2021; Alnaqbi, 2020; Alraasibia, 2021; El-hajj, 2019; Haneya et al., 2021; Johnson et al., 2022; Keezhatta, 2019; Sourani, 2019). Lastly, one paper (3.45%) used a mixed method approach (Aldossary et al., 2020).

Table 2.
Methodology of the selected studies

	Author/Authors	#	%
Quantitative Research	Abdel Baky, 2022; Abdeen, 2021; Alastal et al., 2021; Alhashmi et al., 2021; Al-Zyoud, 2020; Elayyan, 2021; Fouda, 2020; Ghazi, 2021; Hussin et al., 2021; Jabli & Alqahtani, 2022; Mahmoud, 2020; Makhlouf, 2021; Mawad et al., 2019; Mirat & Katie, 2019; Mohammed et al., 2021; Nagro, 2021; Nasif, 2021; Yanes et al., 2020.	18	62.07
Qualitative Research	Abalkheel, 2022; Abuzakiyeh, 2018; Albasalah et al., 2021; Alnaqbi, 2020; Alraasibia, 2021; El-hajj, 2019; Haneya et al., 2021; Johnson et al., 2022; Keezhatta, 2019; Sourani, 2019.	10	34.48
Mixed research	Aldossary et al., 2020.	1	3.45
		29	100

Source (own author)

The selected papers were searched in Scimago and Web of Science to recognize the ranking of journals according to these databases. According to Scimago's four categories (Q1, Q2, Q3, and Q4), the highest rank is Q1 and the lowest rank is Q4. There were two papers published in Q1 and Q2. Three papers were published in Q3. However, eight papers were published on Web of Science, and seventeen papers were not ranked in either Scimago or Web of Science as shown in Table 3.

Table 3
Studies ranking and published journals

#	Author/ Authors	Journal Name	Scimago	Web Of Science
1	Abalkheel, 2022	International Journal of English Language and Literature Studies	Q2	
2	Abdeen, 2021	International Journal of Childhood, Counselling and Special Education		
3	Abdel Baky, 2022	Journal of Education - Sohag University		
4	Abuzakiyeh, 2018	Journal of Faculties of Education, University of Al-Zawiya		
5	Alastal et al., 2021	Journal of the Islamic University of Educational and Psychological Studies		
6	Albasalah et al., 2021	Linguistica Antverpiensia, New Series: Themes in Translation Studies	Q1	X
	Aldossary et al., 2020	Palarch's Journal Of Archaeology Of Egypt/Egyptology	Q3	
8	Alhashmi et al., 2021	Journal of Information Technology Education: Research	Q2	X
9	Alnaqbi, 2020	Electronic Interdisciplinary Miscellaneous Journal		
10	Alraasibia, 2021	Al-Andalus Journal for Humanities and Social Sciences		
11	Al-Zyoud, 2020	Universal Journal of Educational Research		
12	Elayyan, 2021	Journal of Educational Technology & Online Learning		
13	El-hajj, 2019	Innovation Arabia 12 Proceedings		

14	Fouda, 2020	Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development		X
15	Ghazi, 2021	Journal of Sport Science Technology and Physical Activities		
16	Haneya et al., 2021	Procedia Computer Science		
17	Hussin et al., 2021	The 1st International Conference of the Faculties of Sciences		
18	Jabli & Alqahtani, 2022	Association of Arab Universities Journal for Education and Psychology		
19	Johnson et al., 2022	Association for the Advancement of Artificial Intelligence		X
20	Keezhatta, 2019	Arab World English Journal		X
21	Mahmoud, 2020	International Journal of Research in Educational Sciences		X
22	Makhlouf, 2021	International Journal of English Language Education		X
23	Mawad et al, 2019	Journal of the College of Education, Al-Azhar University		
24	Mira & Katie, 2019	Journal Intelligence Researches		
25	Mohammed et al., 2021	Multicultural Education	Q3	
26	Nagro, 2021	International Journal of Education and Practice	Q3	
27	Nasif, 2021	Journal of Art & Architecture Research Studies		
28	Sourani, 2019	AlJinan Journal - AlJinan Unversity		
29	Yanes et al., 2020	IEEE Access	Q1	X

Source (own author)

Table 4 showed that there were two types of institutions where the studies were conducted; nineteen papers (65.52%) were conducted in Universities (Abdel Baky, 2022; Abdeen, 2021; Alastal, et al., 2021; Alhashmi et al., 2021; Al-Zyoud, 2020; Elayyan, 2021; Fouda, 2020; Ghazi, 2021; Hussin et al., 2021; Jabli & Alqahtani, 2022; Mahmoud, 2020; Makhlouf, 2021; Mawad, 2019; Mira & Katie, 2019; Mohammed et al., 2021; Nagro, 2021; Nasif, 2021; Yanes et al., 2020) and ten papers (34.48%) originated in schools (Abalkheel, 2022; Abuzakiyeh, 2018; Albasalah et al., 2021; Alnaqbi, 2020; Alraasibia, 2021; El-hajj, 2019; Haneya et al., 2021; Johnson et al., 2022; Keezhatta, 2019; Sourani, 2019).

Table 4.
Type of Institutions

	Author/Authors	#	%
Universities	Abdel Baky, 2022; Abdeen, 2021; Alastal et al., 2021; Alhashmi et al., 2021; Al-Zyoud, 2020; Elayyan, 2021; Fouda, 2020; Ghazi, 2021; Hussin et al., 2021; Jabli & Alqahtani, 2022; Mahmoud, 2020; Makhlouf, 2021; Mawad et al., 2019; Mira & Katie, 2019; Mohammed et al., 2021; Nagro, 2021; Nasif, 2021; Yanes et al., 2020; Aldossary et al., 2020.	19	65.52
Schools	Abalkheel, 2022; Abuzakiyeh, 2018; Albasalah et al., 2021; Alnaqbi, 2020; Alraasibia, 2021; El-hajj, 2019; Haneya et al., 2021; Johnson et al., 2022; Keezhatta, 2019; Sourani, 2019.	10	34.48

Source (own author)

The goal of the studies

The goal of the studies was to assess the utilization of Artificial Intelligence in the education sector in the Arab world in four categories that explored AI usefulness, AI effectiveness during the COVID-19 pandemic, teacher and student views and awareness of AI, and AI training and program development.

AI usefulness has been explored in multiple studies. A 2022 study by Abalkheel questioned the usefulness of Artificial Intelligence (AI) in improving Saudi education quality and effectiveness. Similar to Abalkheel (2022), an AI-based learning environment was used by Abdel Baky (2022) to identify its impact on student achievement and decision-making skills. Abdeen (2021) also assessed how the exploitation strategy enhanced students' ability to think concurrently. In addition, El-hajj's (2019) study goal was to show how AI and other technologies are improving educational systems and speeding up administrative processes worldwide. Alnaqbi (2020) also assessed the effectiveness of AI in overcoming military education challenges. Moreover, Keezhatta's (2019) study aimed to know the effect of AI application in the linguistics field, specifically its effects on Natural Language Processing (NLP) platforms. AI was also used to teach and evaluate some basic karate skills for primary school students in Ghazi's study (2021). Furthermore, Makhlouf (2021) investigated the effect of AI on the development of non-English major students in their preparatory year. Additionally, Fouda (2020) analyzed prior research to assess the uses of fourth industrial revolution (4IR) technologies in the field of agricultural engineering. A systematic review by Sourani (2019) explored the role and potentiality of AI in improving education.

AI effectiveness was also examined during the COVID-19 pandemic. A study explored the possibilities provided by AI and its uses, as well as the optimization of student and professor performance (Hussin et al., 2021). Haneya et al. (2021) analyzed the application and impact of AI on the COVID-19 outbreak and discussed the contribution of AI in the fight against the pandemic. Similarly, Nagro (2021) investigated the role of e-learning and AI in improving faculty members' practices when switching to online education during COVID. Another study aimed to identify AI and those of its applications that could be used to enhance the educational process in light of the imposed COVID-19 challenges in Egypt (Mahmoud, 2020).

The views and awareness of teachers and students on using AI in education have also been examined. In the UAE, Alhashmi et al. (2021) explored the views of Arab teachers and students concerning the use of humanoid robots as teaching assistants. In addition, pre-service science teachers' perceptions of the impact of fourth industrial revolution products, including artificial intelligence, on education are examined

in Elayyan's (2021) study. Moreover, Albasalah et al. (2021) analyzed the barriers to the use of AI and the exploitation of the information revolution in scientific research in a wide range of fields, and they also assessed the objectives of scientific research using AI in universities. Nasif (2021) also evaluated the current state and challenges facing students and the role of AI in facing them. In addition to identifying the barriers and challenges of educational research, Aldossary et al. (2020) explored the differences in the perceived challenge between males and females. Another study aimed to identify IQs applications (AI) in teaching from university lecturers' points of view (Mira & Katie, 2019). A recent study assessed faculty members' awareness of AI skills and their relationship with experience and training (Jabli & Alqahtani, 2022).

When it comes to AI training and program development, one study discussed aspects of development that should occur in the educational system, including AI development (Alraasibia, 2021). Another study in Libya aimed to understand AI, its applications, and the components of expert systems, as well as to explain the advantages of computer-assisted teaching programs (Abuzakiyeh, 2018). Mawad's (2019) goal was to design an environment that develops digital skills and technological acceptance among the faculty, based on their preferred training style. Similarly, Mohammed et al.'s (2021) study's goal was to use AI techniques to develop a university's teacher preparation programs. Al-Zyoud (2020) also explored the development of AI and its impact on the educational systems and the teachers' professional development. Johnson et al. (2022) developed an AI course that aimed to provide a broad introduction to AI and give students enough knowledge to be able to apply their learning to their work. Yanes et al.'s (2020) goals were to develop and use a machine-based recommender system to assess courses and predict suitable actions. Another study developed a proposed model based on AI and aimed to reveal its effectiveness in developing skills in programming for university students (Alastal et al., 2021).

Results of the studies

Results from AI usefulness showed a consistent pattern that supports AI's positive impact. Sourani (2019) showed that AI could play an instrumental role by developing a digital curriculum and educational activities, along with adopting Chat-bot related Apps. Abalkheel (2022) found that AI can help Saudi instructors

in closing the gaps present in education and overcoming the challenges caused by the pandemic. Abdel Baky (2022) also found that an AI-based learning environment resulted in a significant difference in college students' mean achievement scores, as well as a significant difference in their decision-making skills and direction toward technology, as compared to students who were taught in a traditional learning environment. The results from Abdeen (2021) showed that the use of exploitation strategy has significantly enhanced the level of their concurrent thinking ability and a significant variation in this level was noted between the experimental and control groups. In addition, El-hajj (2019) reported that AI provides economic, personalized education to a wide range of learners, which can contribute to the transformation of the education sector. Similarly, the study in the UAE demonstrated that AI is useful in reducing risks and challenges in education for the military sector (Alnaqbi, 2020). Keezhatta's (2019) study results also show that AI can support NLP tasks, especially when deep learning techniques are applied to extract analytical inferences from EFL texts. When it comes to sports, the use of AI-assisted teaching and evaluation of some basic karate skills was effective, as it was in teaching and assessing the program (Ghazi, 2021). Makhlouf (2021) found that AI enhanced students' speaking skills with a significant difference in scores. In the future, Fouda (2020) concluded that Arab countries will need continuous and flexible education, which can be achieved by increased investment in education and research.

As for the results of AI effectiveness during the pandemic, Haneya et al. (2021) found that AI applications prevented COVID-19 from spreading, monitored restrictions, and provided remote healthcare. Another study explained that the covid pandemic has increased interest in distance education and the use of artificial intelligence techniques (Hussin et al., 2021). Nagro (2021) also found that teachers reported a statistically significant ($\alpha \leq 0.05$) effect of AI on e-learning during the pandemic. However, another study reported that digital infrastructure was not readily available in the educational environment, and teachers and learners were not trained to use modern technologies, considering that paper textbooks remain the main mode of instruction (Mahmoud, 2020).

When it comes to the views and awareness of teachers and students, inconsistency in results was reported. Alhashmi et al. (2021) showed that students were happy with using robots as co-

teachers, unlike teachers, who reported some concerns and were more suspicious. Moreover, the results from Elayyan's (2021) study showed that some teachers favored their use, whereas others reported that teaching-learning processes would occur with little interaction between the teachers and students. Pre-service science teachers also perceived the use of AI and technology differently in Al-Zyoud's (2020) study. Another study's results showed that the applications of AI had a positive effect on teaching, and the application of "instant evaluation" is more effective than others (Mira & Katie, 2019). On the other hand, Nasif (2021) noted that AI is still in its beginning stages, according to the teachers, and its integration for usage, especially in interior design programs, is still very limited in Egypt, specifically for teaching. Albasalah et al. (2021) concluded that teachers reported the objectives of scientific research using AI in universities to be a significant positive predictor of obstacles to activating AI and exploiting the information revolution in health and human scientific research. The obstacles identified include a lack of qualified faculty members to prepare for interdisciplinary research using AI, the lack of educational means and modern educational technology provided by the university, weak training of faculty members, and a failure to follow up. Aldossary et al. (2020) also reported multiple challenges to conducting educational research with AI, including scientific, administrative, psychological, and health factors. Teachers' awareness of AI was explored in one study. The results showed a high level of AI awareness among teachers, but a significant difference is noted according to differences in training received and years of experience (Jabli & Alqahtani, 2022). Mohammed et al.'s (2021) results reported that teachers strongly agreed that there are obstacles to using AI techniques in developing teacher preparation programs, but they also agreed to the proposals suggesting improvements.

When it comes to developing AI and training programs, Johnson et al. (2022) showed that developing and delivering AI courses can yield meaningful student and teachers' perspectives to teach AI at different levels. In addition, the use of AI models has significantly improved programming skills among students, as noted through grade variation (Alastal et al., 2021). Another study reported that 4G will bring about profound changes in all elements of the educational system, which will impose new roles and responsibilities on those working in education systems (Alraasibia, 2021). Mawad

(2019) reported that the participatory training style contributed to the development of digital competencies and technological acceptance among faculty members. Additionally, Yanes et al. (2020) indicated that the use of course specifications, academic records, and course result outcomes can help in getting valuable teaching recommendations. Furthermore, the use of AI enables the adaptability of learning materials to the needs of learners and provides opportunities for group learning (Abuzakiyeh, 2018).

Explanations of the results

Alhashmi et al.'s (2021) results mean that adopting any change, such as the use of robots and other methods in teaching, is challenging. This occurs because E-learning and AI have not been extensively investigated in various countries of the Arabic world to assess their effectiveness. Thus, more research similar to Alnaqbi's (2020) paper must be conducted. In addition, Abdeen's (2021) results argue the need to conduct further research on developing concurrent thinking, suggesting that there is a need to work on developing specialized AI strategies for enhancement. Similarly, Albasalah et al.'s (2021) results mean that universities must consider the objectives of scientific research and interdisciplinary research using artificial intelligence and how they affect AI activation.

As for utilizing AI in the education sector, Nagro's (2021) results mean that more education systems must start shifting toward the use of AI for e-learning purposes. In addition, results from the Haneya et al. (2021) study mean that AI must be employed in all sectors within any country, especially given the current pandemic. Though AI has been implemented in some Arabic countries, Sourani's results (2019) indicate a lack of proper trials, testing, and recommendations for the applicability of AI in the education sector, regardless of the fact that it has been proven to overcome educational challenges. Similarly, El-hajj's (2019) study results mean that the adoption of AI and other technologies is still in its infancy in relation to the higher education sector. Elayyan's study (2021) specified that the instructional programs, curricula, learning environments, liquid instructional skills, and student roles need further transformation to keep up with new technology.

As for the countries that have implemented AI and other e-learning technologies, the results from Abalkheel (2022) and Al-Zyoud's (2020) studies mean that more efforts are needed to address the challenges caused by e-learning in Saudi Arabia, and there is a need to consider AI as a critical tool to overcome these challenges. Al-Zyoud (2020) specified that efforts such as designing AI-based educational software, building AI training pathways, and providing accurate databases must be implemented. In addition, the studies conducted in Egypt indicate that more efforts are needed to support the movement toward e-learning and AI involvement (Mahmoud, 2020) and (Nasif, 2021). In addition, many study results show that AI still needs improvement in specific educational areas within Arabic countries. The results from the studies mean that further utilization of AI must be achieved in agricultural engineering (Fouda, 2020), sport (Ghazi, 2021), linguistics (Keezhatta, 2019), and English-speaking skills (Makhlouf, 2021). Moreover, after reporting good AI awareness levels among teachers (Jabli & Alqahtani, 2022), it is time to explore the adoption of AI and its impact on teaching (Jabli & Alqahtani, 2022). Likewise, Mohammed et al.'s (2021) study means that obstacles such as the ones for developing teachers' programs must be addressed and resolved. Similarly, Mawad (2019) noted that it's essential to consider the preferred training pattern when developing digital skills and technological acceptance among teachers. Considering all these factors and other challenges allows teachers and leadership to properly prepare their students for the 4G Revolution (Alraasibia, 2021)

When it comes to educational organizations, they play a critical role in supporting the involvement of AI within a facility and the students' easy adoption, such as seen in awareness program efforts (Mira & Katie, 2019). Therefore, universities and educational systems must work on improving their infrastructure to support the movement toward remote learning and the employment of AI techniques (Hussin et al., 2021). Additionally, further models must be developed to support improvements in teaching and student performance (Alastal et al., 2021). While new theories of this science are still being developed, some techniques based on it are becoming more widely used in the scientific community, meaning that Arabic countries require additional studies (Abuzakiyeh, 2018).

As Yanes et al. (2020) showed, countries are developing new artificial intelligence systems, so proposing new systems can lead to new recommendations that will further enhance learning.

Similarities and differences among these studies

The assessed studies have many similarities. First, the studies are conducted in Arabic countries such as Saudi Arabia, the UAE, and Lebanon and discuss the topic of Artificial Intelligence in the education sector (Mohammed et al., 2021; Alhashmi et al., 2021; Sourani, 2019). Second, the main focus of the studies, whether they explore artificial intelligence usefulness, teacher and students' perspectives, or artificial intelligence development programs, is to focus on the new challenges and gaps that exist at different levels and could possibly affect the future implementation of artificial intelligence in education systems of Arabic countries (Yanes et al., 2020; Alastal et al., 2021; Mira & Katie, 2019). Third, the studies explore artificial intelligence as a new science offering a variety of possible applications and impacts; thus, all the studies provided an introduction and exploration of artificial intelligence, how it works, and its importance during the COVID-19 pandemic, before proceeding with their main topic (Abuzakiyeh, 2018; Alraasibia, 2021; Mahmoud, 2020). Fourth, all the articles involve teachers in their sample, considering that teachers are the most valuable resource of any educational system, and the success of educating the population heavily relies on them (Mohammed et al., 2021; Nagro, 2021). Fifth, the articles agree that Arabic countries' infrastructure and utilization of available resources still need lots of work in order for artificial intelligence to be properly and efficiently utilized within educational systems (Hussin et al., 2021; Mira & Katie, 2019).

The studies, though they discuss the main general topic, reported many differences. First, the studies were conducted in different countries, including the KSA, UAE, Libya, Oman, and Egypt. Second, the research papers explored different subtopics, such as AI usefulness, AI effectiveness during the COVID-19 pandemic, AI training and program development, as well as the views and awareness of teachers and students on using AI in education. Third, the studies show variation in the setting, the sample selected, and the study variables. For example, the sample was teachers in some studies (Al-Zyoud, 2020; Elayyan, 2021), while others included both teachers and students. In addition, the gender of the study samples varied, as studies included females, males, or a mix of both. Other studies, such as Aldossary et al. (2020), explored the difference in challenges between males and females. In addition, the majority of articles

either used the control-experimental research design (Abdeen, 2021; Abdel Baky, 2022; Makhlouf, 2021) or the descriptive research design (Aldossary et al., 2020; Fouda, 2020) to achieve their goals. Other authors chose to write a literary review (Alnaqbi, 2020), while some, like El-hajj (2019) and Alhashmi, Mubin & Baroud (2021), followed different qualitative methodologies. Moreover, Sourani (2019) and Haneya et al. (2021) used a systematic review and a meta-analysis, respectively, to collect the data from all the studies on artificial intelligence. Other differences include the use of different learning models and systems in the studies. The Kolb model was adopted in the learning system in Saudi Arabia (Abalkheel, 2022; Abdel Baky, 2022), while a machine-based recommender system was adopted in the Yanes et al. (2020) study. The majority of the other remaining studies constructed their own questionnaire to achieve their study objectives. In addition, the studies explored the utilization of artificial intelligence in different educational fields. For example, Alnaqbi (2020) explored the utilization of AI in military education. Fouda (2020) explored 4G technology implementation in the field of agricultural engineering, while Keezhatta (2019) explored the relationship between AI application and the linguistics field, specifically Natural Language Processing (NLP) platforms.

Conclusions

This study presented how artificial intelligence was used in education research from January 2018 to July 2022 to have a clearer view of AI in the Arab world. This systematic literature review explores selected papers that applied artificial intelligence in the education sector in different Arabic countries. The study also analyzed 29 selected studies according to the goal of the studies, methodology, and results. Similarities and differences were discussed among the selected papers. Each of these topics was explored in depth to have a clear view of AI in education in Arabic countries. Four other categories were also discussed: the countries of the selected studies and field of the first author, types of methodology, ranking journals that published these studies, and types of institutions. Many scholars reported that AI is considered a new technology that is helpful in the learning process. Therefore, it was applied in different subjects, such as applied languages, medicine, and science (Jabli & Alqahtani, 2022; Mahmoud, 2020; Makhlouf, 2021; Mawad, 2019; Mira & Katie, 2019; Mohammed et al., 2021). AI was also a good solution during the COVID-19 pandemic for supporting students in their

learning. In addition, Arab governments supported Universities in using this new method of learning in their academic programs, and also provided developmental training courses for various technologies during the pandemic (Abdeen, 2021; Alastal, et al., 2021; Alhashmi et al., 2021; Al-Zyoud, 2020; Elayyan, 2021; Fouda, 2020).

To conclude, there will be many aspects of education where artificial intelligence will continue to assist humans in the future. Thus, more research, resources, and funding are needed by governments. Arabic countries must continue to invest in and utilize AI within their systems to keep up with the quickly-changing world.

Bibliographic references

Abalkheel, A. (2022). Amalgamating Bloom's taxonomy and artificial intelligence to face the challenges of online EFL learning amid post-COVID-19 in Saudi Arabia. International Journal of English Language and Literature Studies, 11(1), 16-30.

Abdeen, S. A. (2021). The effect of exploitation strategy on concurrent thinking ability abilities of students in Saudi Arabia. International Journal of Childhood, Counselling and Special Education, 3(1).

Abdel Baky, N. (2022). The Effectiveness of an Artificial Intelligence Based Learning Environment in Developing Academic Achievement, Decision-Making Skills and Attitude towards Technology Among the Female Students of the College of Education at King Khalid University Considering of Kolb's Model. Journal of Education - Sohag University, 96(96), 1-45.

Abuzakiyeh, K. (2018). Expert systems in artificial intelligence and their employment in education and education. Journal of Faculties of Education, University of Al-Zawiya, 12. Retrieved from http://www.dspace.zu.edu.ly/bitstream/handle/1/315/12.pdf?sequence=5&isAllowed=y

Alastal, M, Aqel, M & Al-Agha, I. (2021). Developing a proposed model based on artificial intelligence and its effectiveness in developing programming skills among students of the University College of Science and Technology in Khan Yunis. Journal of the Islamic University of Educational and Psychological Studies, 29(2). [In Arabic]

Albasalah, A., Alshawwa, S., & Alarnous, R. (2021). Activating the role of Saudi universities in the renaissance and development of interdisciplinary scientific research between various health sciences and others using artificial intelligence. Linguistica Antverpiensia, New Series–Themes in Translation Studies, 20, 45-66.

Aldossary, N., Zoghary, S., El-Sayed, S, & Helali, M. (2020). Challenges of conducting educational research among postgraduate students of Imam Abdulrahman Bin Faisal university in the light of covid-19. PalArch's Journal of Archaeology of Egypt/Egyptology, 17(5), 285-304.

Alhashmi, M., Mubin, O., & Baroud, R. (2021). Examining the use of robots as teacher assistants in UAE classrooms: teacher and student perspectives. Journal of Information Technology Education: Research, 20, 245-261.

Alnaqbi, A. M. (2020). The role of using AI techniques in enhancing e-learning in the military education process. Electronic Interdisciplinary Miscellaneous Journal, 31.

Alraasibia, A. (2021). Mechanisms for developing teaching and learning in the Sultanate of Oman in accordance with the requirements of the Fourth Industrial Revolution. Al-Andalus Journal for Humanities and Social Sciences, 45(8). Retrieved from http://www.andalusuniv.net/AUSTNEW/magazine/sh/2021/8/45/7908bbd5015f9b3e7b57ceefdd1580d1.pdf

Al-Zyoud, H. (2020). The Role of Artificial Intelligence in Teacher Professional Development. Universal Journal of Educational Research, 8(11B), 6263-6272.

Elayyan, S. (2021). The future of education according to the fourth industrial revolution. Journal of Educational Technology and Online Learning, 4(1), 23-30

El-hajj, W. (2019). The Educators' Role after AI. Innovation Arabia 12 Proceedings, 18.

Fouda, T. (2020). Impact of the fourth industrial revolution on the development of scientific research in the field of agricultural engineering in Egypt and Arab World. Scientific Papers Series-Management, Economic Engineering in Agriculture and Rural Development, 20(3), 253-258.

Ghazi, M. (2021). The role of artificial intelligence in teaching and evaluating some of the basic skills in karate. Journal of Sport Science Technology and Physical Activities, 2(2)

Haneya, H., AlKaf, D., Bajammal, F., & Brahimi, T. (2021). A Meta-Analysis of Artificial Intelligence Applications for Tracking COVID-19: The Case of the UAE. Procedia Computer Science, 194, 180-189.

Hussin, A., Salman, R., & Abdullah, M. (2021). The extent to which artificial intelligence techniques contribute to the development and improvement of e-learning applications "Libyan universities as a model". The 1st International Conference of the Faculties of Sciences. [File PDF] Retrieved from https://dspace.zu.edu.ly/bitstream/handle/1/1751/a4p3.pdf?sequence=1&isAllowed=y

Jabli, N & Alqahtani, S. (2022). The degree of faculty members' awareness of artificial intelligence skills in education and its' relationship to experience and training programs at King Khalid University. Association of Arab Universities Journal for Education and Psychology, 19(3). [In Arabic]

Johnson, D., Alsharid, M., El-Bouri, R., Mehdi, N., Shamout, F., Szenicer, A., & Binghalib, S. (2022). An Experience Report of Executive-Level Artificial Intelligence Education in the United Arab Emirates. Association for the Advancement of Artificial Intelligence.

Keezhatta, M. S. (2019). Understanding EFL linguistic models through relationship between natural language processing and artificial intelligence applications. Arab World English Journal, 10(4), 251-262.

Mahmoud, A. (2020). Artificial intelligence applications: An Introduction to Education Development in the light of Corona Virus Pandemic COVID 19 Challenges. International Journal of Research in Educational Sciences, 3(4).

Makhlouf, M. K. I. (2021). Effect of Artificial Intelligence-Based Application on Saudi Preparatory-Year Students' EFL Speaking Skills at Albaha University. International Journal of English Language Education, 9(2).

Mawad, G. (2019). The effectiveness of a widespread training environment based on the preferred training pattern for the development of digital efficiency and technological acceptance by faculty Prince Sattam Bin Abdulaziz University. Journal of the College of Education, Al-Azhar University, 184(3).

Mira, A., & Katie, T. (2019). Applications of artificial intelligence in education from the point of view of faculties members at Universities. Psychological Science, Volume Conference, (22). Retrieved from https://www.iasj.net/iasj/article/178318

Mohammed, A., Ali, R., & Alharbi, A. (2021). The reality of using artificial intelligence techniques in teacher preparation programs in light of the opinions of faculty members: A Case Study in Saudi Qassim University. Multicultural Education, 7(1).

Nagro, S. A. (2021). The Role of Artificial Intelligence Techniqies in Improving the Behavior and Practices of Faculty Members When Switching to E-Learning in Light of the Covid-19 Crisis. International Journal of Education and Practice, 9(4), 687-714.

Nasif, S. (2021). Facing monotonous (Non-Design Studio) unit courses challenges by updated teaching strategies using artificial intelligence. Journal of Arts & Architecture Research Studies, 2(4), 103-118.

Sourani, M. (2019). Artificial Intelligence: A Prospective or Real Option for Education? AlJinan Journal - AlJinan Unversity, 11(1), 121-139.

Yanes, N., Mostafa, A., Ezz, M., & Almuayqil, S. (2020). A machine learning-based recommender system for improving students learning experiences. IEEE Access, 8.