IAES International Journal of Artificial Intelligence (IJ-AI)
Vol. 15, No. 4, August 2026, pp. 2985~2998
ISSN: 2252-8938, DOI: 10.11591/ijai.v15.i4.pp2985-2998

Leveraging artificial intelligence in education a comprehensive review of the Arab literature

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Article Info

Article history:

Received Jun 7, 2025
Revised Apr 26, 2026
Accepted May 24, 2026

Keywords:

Digital revolution
Education administration
Empowering teachers
Enhancing teaching
Learners' learning
Learning assessment
Narrative review

ABSTRACT

This descriptive analytical study relied on the systematic literature review (SLR) addressing the role of artificial intelligence (AI) in improving education management and delivery, empowering teaching and teachers, learner learning, and learning assessment. The SLR sample was determined in 125 articles from Almandumah and Scopus databases. The analysis results revealed: 39.2% of articles were related to the Saudi Arabia context, 34.4% were published in 2024, and 68.8% were quantitative. The most prominent AI applications used were: ChatGPT, Alexa, Grammarly, Duolingo, Chatbot, and Coursera. The results also showed that the most areas of the educational process in which AI applications can be implemented were: empowering teaching and teachers (62.4%), and improving learner learning (48.8%). The SLR also came up with some practices that can be applied to enhance the AI use in improving the educational process. An opinion poll was applied on 37 academic experts to identify their agreement on the potential of implementing these developed practices in the areas of the educational process. The results showed that the experts' agreement on the potential of implementing these practices in the areas of the educational process was very high. The study recommended some useful mechanisms for implementing these practices.

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1. INTRODUCTION

Artificial intelligence (AI) stands out as one of the most significant outcomes of the innovations and transformations associated with the fourth industrial revolution (Industry 4.0). Its applications are diverse, impacting various facets of life, and it is poised to radically alter the human experience. This growing influence is reflected in contemporary research, with AI emerging as one of the most frequently searched terms. In the Arab world alone, recent reports from Almandumah [1] indicate that AI has been searched 25,917 times, highlighting its increasing relevance.

According to the Organization for Economic Co-operation and Development, AI plays a pivotal role in achieving sustainable development by enhancing efficiency across major sectors [2]. Its necessity extends beyond merely addressing current challenges; it encompasses the potential for innovation and planning, aiming toward a more sustainable future. AI facilitates the discovery of innovative solutions to complex problems [3] and the development of systems that can learn, reason, and adapt to new conditions. This adaptability enables AI to support human activities in unprecedented ways, as well as perform functions that

exceed human capabilities in numerous fields. Thus, AI not only changes existing paradigms but also opens new avenues for progress and development [4].

In the educational context, AI applications have also radically transformed education. Reports issued by UNESCO [5] indicated the ability of AI to improve the educational process by automating its various aspects, such as administrative tasks, assessment, and personalized learning. Many studies [6]–[11] have also asserted that AI technology enables new strategies and programs that were previously unavailable, such as language comprehension, letter recognition and reading, speech synthesis, natural language processing, big data, bots, robotics, 3D printers, the internet of things, neural networks, virtual reality, augmented reality, and intelligent tutoring systems. Moreover, in studies [12]–[15] have also confirmed that AI applications help overcome many educational challenges by facilitating the teaching function and increasing the efficiency of information delivery in modern and accessible ways. The effective use of AI systems offers significant opportunities to improve student learning, personalize education to meet individual needs, develop new educational models that enhance the educational experience, improve student assessment, and provide immediate technical support and guidance to students.

On the other hand, other studies have shown that the use of AI applications in education poses numerous threats and challenges that must be addressed to ensure a safe and equitable learning environment. The collection and analysis of students' data may lead to a violation of their privacy, especially if there are no clear data protection policies or if it is used for non-educational purposes [16]–[18]. AI algorithms may also reflect or reinforce biases included in the data, leading to unfair or discriminatory decisions against some students. Overreliance on AI may marginalize the role of human teachers and raise concerns about a loss of control over the educational process. Furthermore, it is sometimes unclear who bears responsibility when errors or harm result from AI decisions take place, creating an accountability gap [19]. Another threat is the difficulty of assessing the credibility of the information provided by AI. This requires enhancing critical thinking among students and teachers, and establishing clear legislation and ethical guidelines to regulate the use of AI in education [20].

Based on what was mentioned, the steady increase in the number of AI research in education may result in discrepancies in the results that address similar research issues. This increases the difficulty of making decisions in light of this discrepancy, on the one hand, and reduces the opportunities to benefit from it in improving the educational process, on the other hand. To eliminate inconsistencies among such results, this requires a systematic literature review (SLR) related to the role of AI applications in improving the educational process. This method helps to synthesize results and formulate them in a unified and integrated manner that enables a comprehensive understanding and, subsequently, leveraging from them in reaching conclusions and generalizations that confirm their effectiveness and enable decision-makers to rely on them.

The SLR is the most appropriate meta-analysis method to achieve this, as it relies on collecting, scanning, organizing, extracting, and summarizing information from a vast amount of data in a specific field. This aims to extrapolate useful generalizations from that data in a more objective, reliable, and dependable manner. This also helps to reach a general conclusion regarding the effectiveness of this research, and thus, a specific decision can be made regarding whether or not to adopt the results of these studies [21]–[23]. Given the scarcity of Arab literature in the current research field and specifically depending on the systematic review of Arab educational literature (SRAEL), this current study seeks to extract practices that enhance the educational process in the areas of education management and delivery, empowering teaching and teachers, learning, and learning assessment. This study seeks to answer the following questions: i) what are the research trends of the Arab literature that address AI use in the educational process? ii) what are the most prominent AI applications used in the educational process? iii) to what extent does the SRAEL reflect the potential of implementing AI practices in the following areas of the educational process: education management and delivery, empowering teaching and teachers, learner learning, and learning assessment? and iv) to what extent do academic experts agree on the potential of implementing AI practices in the areas of the educational process?

2. THEORETICAL BACKGROUND

The contemporary technological revolution necessitates implementing AI in all societal systems, most importantly the educational system, as it is the primary contributor to achieving societal policy and desired educational goals. AI is based on a group of sciences, such as computer science, psychology, engineering, mathematics, and linguistics. It creates and develops intelligent systems capable of simulating human intelligence for achieving intelligent results [24] and increasing human well-being [25]. Not all devices and applications fall under the umbrella of AI; rather, what is capable of learning and understanding from previous experiences, implementing them in new situations, managing information, finding relationships, making decisions, discovering and applying knowledge, responding quickly to new variables,

dealing with ambiguous situations, and being creative in understanding and perceiving visible matters [26]. This is done through what is known as the knowledge engineering process, which takes place in five stages: i) knowledge acquisition, where a large database is stored within the AI software from various sources; ii) knowledge representation, where the AI software organizes the acquired knowledge to make it ready for use; iii) knowledge validation, where the software conducts tests on the validity of knowledge to ensure its quality; iv) inference, where the AI software inducts and deduces to build higher levels of knowledge that can be used to solve problems; and v) explanation and justification, where new knowledge that represents the solution to the problem is presented using appropriate presentation methods [27].

Implementing AI in the educational process is based on several theories, including constructivist learning theory, which has developed massive open online courses (MOOCs), personalized learning environments, and adaptive learning systems that emphasize individuality and AI-driven learning [28]. According to this theory, the learner seeks out information and builds knowledge internally through active learning, practice, peer support, and collaboration via technology. Therefore, AI systems and applications in education should be designed to enhance individual or adaptive learning, enhance human intelligence, and promote human-machine collaboration [29].

Among the theories underlying the use of AI in the educational process is the theory of technological determinism, which emerged in the second half of the Twentieth Century by Rogers. This theory focuses on the adoption of new and innovative ideas by society members with the aim of achieving societal development. This process goes through five stages: i) the awareness stage (knowledge), where individuals learn about a new idea regarding an invention and attempt to identify its functions; ii) the interest stage (conviction), where the individual develops a sense of support or opposition to the use of the new innovation; iii) the evaluation stage (decision-making) in terms of adopting or rejecting the use of the new innovation; iv) the experimentation stage (implementation); and v) the adoption stage (confirmation), where the user supports the use of the new technological innovation and affirms its importance [30].

In response to the rapid expansion of Web 2.0 technologies and the increasing complexity of digital learning environments, George Siemens introduced connectivism theory in 2004 as a new learning paradigm designed to explain how knowledge is acquired, shared, and developed in the digital age. Unlike traditional learning theories that focus primarily on individual cognitive processes, connectivism views learning as a networked process in which knowledge is distributed across people, digital tools, technological systems, and online communities. The theory is built on eight core principles, including the importance of diverse perspectives, the creation and maintenance of learning networks, and the recognition that learning can occur both within and outside the individual through technological resources such as databases, social media platforms, and digital repositories. Furthermore, connectivism emphasizes that the ability to locate, evaluate, and update information is more valuable than merely acquiring static knowledge, given the rapid pace at which information changes in contemporary society. It also highlights the learner's capacity to identify relationships among ideas, concepts, and disciplines, thereby promoting critical thinking and lifelong learning. From this perspective, decision-making is considered a learning activity in itself because learners must continuously evaluate information, select relevant knowledge, and adapt to emerging developments in digital environments. Hence, connectivism theory provides a strong theoretical foundation for integrating digital technologies into education and fostering the competencies required for effective participation in knowledge-based and digitally connected societies [31].

All of these theories emphasize the importance of investing in technology in education, which cannot be isolated from surrounding scientific and technological societal changes. Therefore, the systematic integration of AI into education provides the ability to address the greatest challenges in education, innovate teaching and learning practices, and accelerate progress towards achieving sustainable development goal 4 [32]. Implementing AI in education does not simply mean converting curricula to web pages or compact discs (CDs), but rather transforming them into interactive electronic activities in which the learner is the active participant, researcher, and analyst of information in these environments. The importance of implementing AI in education stems from its applicability at all educational levels, its ease of use, its low operating costs, its ability to enable learners to develop communication skills, and its ability to maximize interactivity, flexibility, and continuity in the teaching and learning process [29].

Reviewing educational literature reveals that AI use in education has a positive impact, as it can: individualize learning according to each learner's interests, tendencies, and needs; increase interaction between learners and academic content [33]; build learning communities capable of research, innovation, and collaborative learning; link education to the requirements of the future labor market [34]; automate grading and assessment, and provide appropriate and fair feedback to each student with greater consistency and reduced human subjectivity [35]. Adaptive learning is also one of the most beneficial and important applications of AI in education, as it contributes to achieving remarkable progress through individualized student learning. It makes necessary adjustments to educational paths, materials, and educational resources based on learners' needs and individual differences, in order to model the ideal online learning environment.

This learning is not only limited to the personal delivery of educational materials to the learner, but it extends to adapting to interact with learners and maintaining their preferences as well. Teachers also use it to provide students with feedback and identify their requirements to keep pace with a more complex world [36], [37].

In addition, smart learning systems and expert systems can be used as diverse educational tools that take into account the sequencing of lessons within the curriculum. Students learn by doing, and these systems calculate the learner's achievement rate and provide feedback tailored to their progress [6]. Thus, a smart assistant or virtual tutor is more effective and beneficial for students who work during school hours, those with limited mental abilities, or those who are more shy about asking questions to the teacher or in front of their peers. Smart learning systems help them continue their educational path, regardless of their abilities or level. Intelligent multimedia learning systems can also help learners with disabilities adapt to the educational process and acquire life skills. These programs offer multiple communication methods (images, graphics, videos, texts, signs, gestures, and other stimuli). Intelligent learning systems can also mimic the behavior of a smart teacher and act as an expert in a particular disability field. An intelligent educational system can teach subjects, detect and correct student errors, modify behavior, develop skills, take individual differences between learners into account, and improve teacher performance through the knowledge base the system provides to teachers [6], [38].

Artificial neural networks can be trained to observe early learning and identify and measure the quality of learning. These networks help process massive amounts of data through machine learning and deep learning. AI algorithms can quickly analyze massive data sets and extract valuable insights and patterns that traditional methods might miss. They can also automate time-consuming tasks, such as data collection, classification, and analysis, to predict potential outcomes and trends, and then more effectively model relationships between data [39]–[41]. It is clear that the use of AI systems and applications in education is no longer a luxury; it is a necessity for improving the educational process, as confirmed by the literature review. To facilitate education management and delivery, educational institutions can use big data from education management information systems—such as student admissions data, timetables, attendance monitoring for students, teachers, and administrators, homework, school and classroom supervision and management—to provide stakeholders with the information they need to analyze learners' personal needs, guide students, predict their academic progress, and formulate policies related to the optimal delivery of educational opportunities to all learners [42], [43].

To improve learner learning, learners can engage in learning activities, track knowledge, enhance learning efficiently, and achieve their personal aspirations through intelligent teaching systems such as Moodle and Open edX. These systems offer exemplary teaching methods for knowledge transfer, such as personalized learning, differentiated instruction, interactive learning, guided exploratory learning, and augmented reality learning. To this end, numerous smart applications are being used in many educational fields, such as Smartmusic, AI Teacher, Amazing English, Duolingo, WriteToLearn, and Robots. All of this confirms AI's interest in the learning process, which has led it to assign a personal tutor to each learner for long life “a smart learning companion”, who provides ongoing support to learners based on their interests, goals, and individual learning paths [44]–[46].

To empower teaching and teachers, AI applications can help teachers reduce their workload by automating tasks such as assessment, plagiarism detection, classroom management, feedback, and providing more effective support to learners. This will, of course, transform teachers' roles and make them keep sustainable professional growth to acquire new competencies that enable them to work effectively with AI. Furthermore, some schools—due to teacher-related issues—have used the dual-teacher model and intelligent teaching assistants to relieve teachers of time-consuming activities [10], [47].

To assess the learning process, AI is expected to transform traditional assessment practices. It uses facial and voice recognition, keyboard dynamics, and text analysis to verify candidates in remote exams. AI also enables the use of testing in high-stakes disciplines, creates multiple alternatives for continuous assessment, and monitors learners' progress and performance skills [10].

Given the global interest in implementing AI to improve education, this study serves as an SRAEL, aiming to identify the most important practices that can be applied to achieve this. This study offers a novel contribution by providing a systematic and context-sensitive synthesis of Arab literature on AI in education, moving beyond descriptive mapping toward critical analysis of methodological, epistemic, and governance dimensions. Unlike global reviews dominated by Western perspectives, it highlights region-specific patterns, including the predominance of quantitative approaches, limited methodological diversity, and emerging ethical challenges. The study further proposes an integrative framework that connects research practices, institutional conditions, and ethical safeguards, offering a structured and scalable model for responsible AI integration in education.

3. METHOD

This study adopted a systematic review approach guided by the preferred reporting items for systematic reviews and meta-analyses (PRISMA) framework to ensure transparency, reproducibility, and methodological rigor in identifying and analyzing relevant literature on the use of AI in education within Arab contexts. The review focused on four key educational domains: education management and delivery, empowering teaching and teachers, learner learning, and learning assessment. The systematic review requires reading the collected literature, analyzing its content in a systematic and precise manner, mining its data, exploring the required information and trends, their development, and then achieving the pre-defined objectives [48].

3.1. Search strategy and data sources (identification stage)

A comprehensive search was conducted across two major databases: Almandumah (for Arabic literature) and Scopus (for international publications). The search strategy combined the following keywords: "artificial intelligence" AND/OR "education" AND/OR "learning" AND/OR "teaching" AND/OR "assessment" AND/OR "management". For the Scopus database, the term "Arab" was additionally included to restrict results to studies conducted within Arab contexts. The search was limited to: peer-reviewed journal articles, publications between 2020 and 2024, and articles available in full text. This initial search yielded 592 records, including 464 Arabic articles (Almandumah) and 128 English articles (Scopus).

3.2. Screening and eligibility criteria

For inclusion criteria, studies were included if they were: addressing AI use in at least one of the four predefined educational domains, conducted within an Arab educational context, empirical or applied studies, published in peer-reviewed journals, or/and available in full text. While exclusion criteria comprised studies that: focused on areas outside the four domains (e.g., knowledge management and data management), addressed AI as a subject of teaching rather than a tool, focused on evaluation of teachers or administrators. Studies were also excluded if they were systematic reviews or conceptual papers, or/and were conducted outside the Arab context (even if authors were affiliated with Arab institutions).

3.3. Study selection process (PRISMA flow)

The study selection process followed the PRISMA framework and proceeded through four stages:

i) Identification: a total of 592 records were identified through database searching.
ii) Screening: after removing 105 duplicate records, 487 studies remained. Titles and abstracts were screened, resulting in the exclusion of 283 studies that did not address the targeted educational domains.
iii) Eligibility: the remaining 204 articles were assessed for full-text eligibility. At this stage, 79 articles were excluded for the following reasons: irrelevant educational focus, non-Arab context despite Arab affiliation, focus on AI as a subject rather than a tool, or/and being review studies.
iv) Inclusion: after applying all inclusion and exclusion criteria, the final sample consisted of 125 studies, including 74 Arabic studies and 51 English studies.

The complete selection process is illustrated in Figure 1 (PRISMA flow diagram).

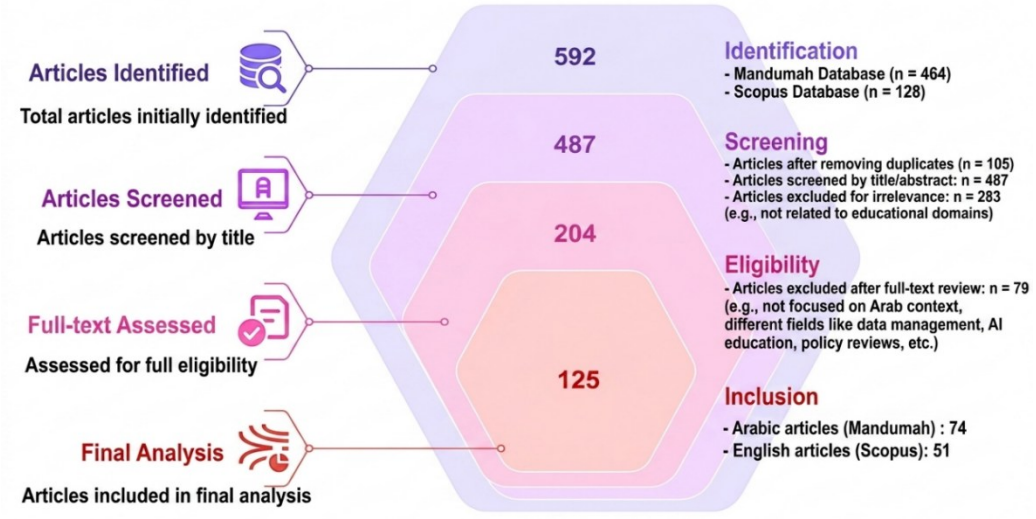

Figure 1. PRISMA flow diagram of the article selection process for final analysis

3.4. Data extraction and coding procedures

A structured data extraction and coding process was employed to systematically analyze the selected studies. The analysis aimed to identify AI-related practices that contribute to improving the four educational domains. The procedure involved: extracting relevant practices from each study, classifying practices into the four predefined domains, coding the extracted data using Microsoft Excel, and coding categories. The coding framework included: educational domain (management, teaching, learning, and assessment), type of AI application, reported outcomes or impacts, and context of implementation.

3.5. Reliability of coding (inter-rater reliability)

To ensure the reliability of the coding process, the analysis was conducted twice by the researcher with a three-week interval between coding rounds. Inter-coder reliability was calculated using Holsti's formula, as in (1).

$$Reliability = \frac{2M}{N_1+N_2} \quad (1)$$

Where M is number of agreements between the two coding rounds, N_1 and N_2 is number of coded units in each round [49]. The analysis yielded a reliability coefficient of 1.00 (100%), indicating perfect consistency between the two coding rounds.

3.6. Expert validation (supplementary data source)

To complement the systematic review findings, a purposive sample of 37 Arab academics was surveyed to assess their level of agreement regarding the importance and applicability of AI practices identified in the review. The sample included: 22 academics from four Egyptian universities, 7 academics from six Saudi universities, 7 academics from Sultan Qaboos University (Oman), and 1 academic from Qatar University. The survey instrument was designed based on the extracted practices and aimed to validate their perceived relevance in real educational contexts.

4. RESULTS AND DISCUSSION

4.1. Answering the first question: what are the research trends of the Arab literature that address AI use in the educational process?

The SRAEL revealed specific characteristics to the geographical, periodical, and methodological context. Regarding the geographical distribution or environmental context, the analysis revealed that the Kingdom of Saudi Arabia is the Arab country that conducted the most research on the role of AI in improving education, with 49 articles, representing 39.2% of the total number of articles. This research focused on several areas, the first of which was the field of "empowering teaching and teachers", which was repeated 41 times. This was followed by the field of "learner learning", which was repeated 17 times, and then the areas of "education management and delivery", and "learning assessment", with three repetitions for each one. Egypt came in the second rank with 25 articles, representing 20% of the total study sample. These articles focused on "learner learning", "empowering teaching and teachers", "learning assessment", and "education management and delivery", with repetitions of 21, 14, 9, and 7 times, respectively.

These results indicate that Arab countries are moving towards leveraging fourth industrial revolution applications—such as cyber systems, cloud computing, AI, the internet of things, nanotechnology, 3D printing, and advanced robotics—to develop soft, digital, and life skills among learners and teachers, enabling them to adapt to the 4G technologies [50]. Consequently, the current educational literature focused on skills such as digital fluency, technological literacy, critical thinking, creativity, cognitive flexibility, knowledge management, emotional intelligence, effective communication, global competence, the ability to leverage resources and information, understanding the ongoing changes in future society, entrepreneurship, digital citizenship, leadership skills, working in virtual environments, the ability to work under pressure, and entrepreneurial thinking to discover and capitalize on opportunities, in addition to specialized cognitive and skill-based skills. Figure 2 illustrates ranking the geographical contexts according to the SRAEL. Regarding the publication periods of the study sample, 17 articles were published in 2020, 24 ones in 2021, 22 in 2022, 19 in 2023, and 43 in 2024, indicating the novelty of this field. Recently published articles at the end of 2024 also revealed that the greatest focus was on "empowering teaching and teachers". The use of AI applications to empower teachers' performance does not diminish their roles; rather, it requires them to develop their digital skills and acquire new skills that keep pace with technological developments. Enhancing smart learning systems and programs in teaching also requires expecting new tasks and roles related to developing teachers' competencies and ensuring their sustainable professional growth. This explains the increasing focus of research in this field. Figure 3 shows the ranking of the publication periods according to the SRAEL.

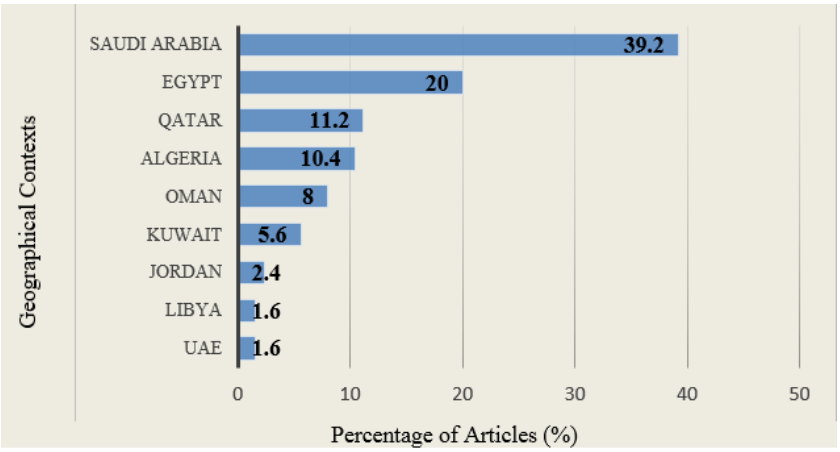

Figure 2. Distribution of AI research in education by geographical context

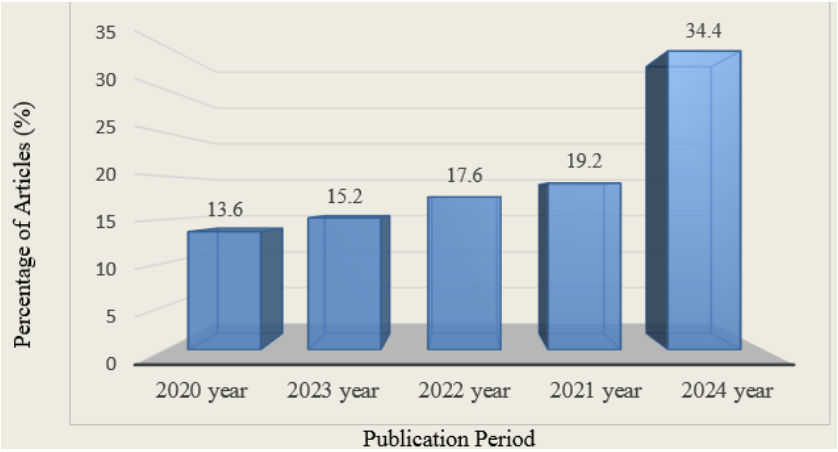

Figure 3. Distribution of AI research in education by publication period

The methodological analysis of included studies revealed a pronounced imbalance in research design approaches. Quantitative methodologies dominated the corpus, accounting for 68.8% of studies, which predominantly employed descriptive and experimental designs utilizing standardized instruments, including questionnaires, psychometric scales, and achievement assessments. Conversely, qualitative approaches represented 31.2% of the literature, encompassing content analysis, narrative inquiry, documentary analysis, and open-ended surveys, alongside a modest number of theory-driven studies grounded in inductive reasoning. While this distribution underscores the field's emphasis on quantitative measurement and statistical generalization, it simultaneously reveals a critical methodological limitation. The preponderance of quantitative research risks privileging measurable variables, such as academic performance, learning outcomes, and attitudinal shifts, at the expense of a nuanced understanding of the contextual, cultural, and pedagogical dimensions that fundamentally shape AI integration within educational ecosystems.

Notably, the restricted application of qualitative inquiry constrains the field's capacity to elucidate how and why AI adoption, interpretation, and implementation unfold across diverse stakeholder perspectives, particularly within Arab educational contexts. This methodological constraint may obscure critical dimensions, including institutional dynamics, ethical implications, user experiences, and sociocultural factors that mediate technology adoption. Furthermore, the conspicuous absence of mixed-methods research represents a significant lacuna in the literature. Mixed-methods designs would synthesize quantitative rigor with qualitative richness, enabling a triangulated, and multidimensional understanding of AI integration. Their minimal presence suggests a fragmentation in methodological approaches, undermining the development of evidence that is both generalizable and contextually responsive. Figure 4 demonstrates the research methodology of the study sample.

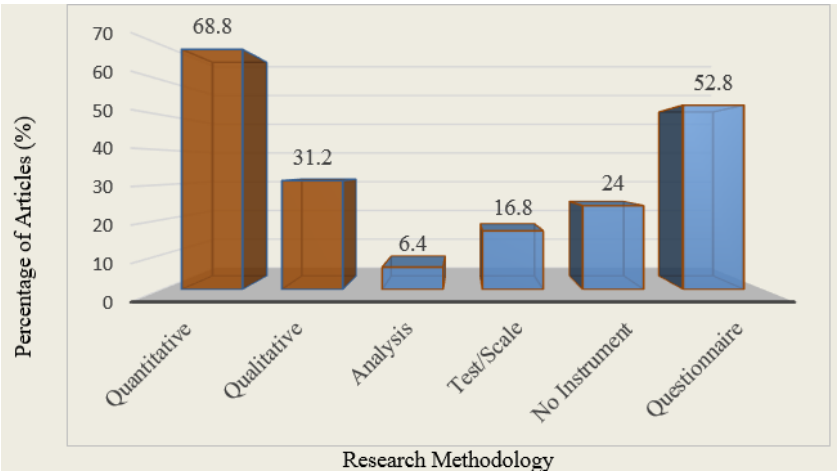

Figure 4. Distribution of AI research in education by research methodology

4.2. Answering the second question: what are the most prominent AI applications used in the educational process?

The SRAEL revealed that there is several AI applications used to improve areas of the educational process. The most used applications were for supporting "learner learning" and "empowering teaching and teachers" processes, but the fewest were used to enhance both "learning assessment" and "empowering teaching and teachers" processes. Figure 5 indicates the most prominent AI applications used in the educational process.

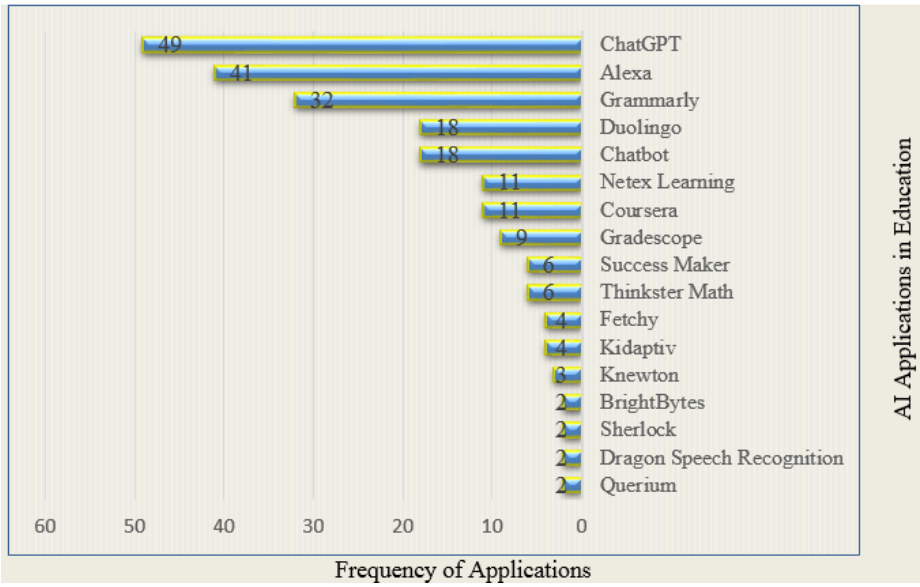

Figure 5. Frequency of AI applications used in the educational process

4.3. Answering the third question: to what extent does the SRAEL reflect the potential of implementing AI practices in the areas of the educational process?

The SRAEL also revealed that AI plays a significant role in improving the four areas of education. The greatest interest was in the area of "empowering teaching and teachers", where this area was asserted in 78 of the 125 articles. This was followed by the area of "learner learning", which was repeated 61 times, then "learning assessment" was repeated 18 times, and at last, "education management and delivery" was repeated 11 times. Figure 6 represents these four areas graphically.

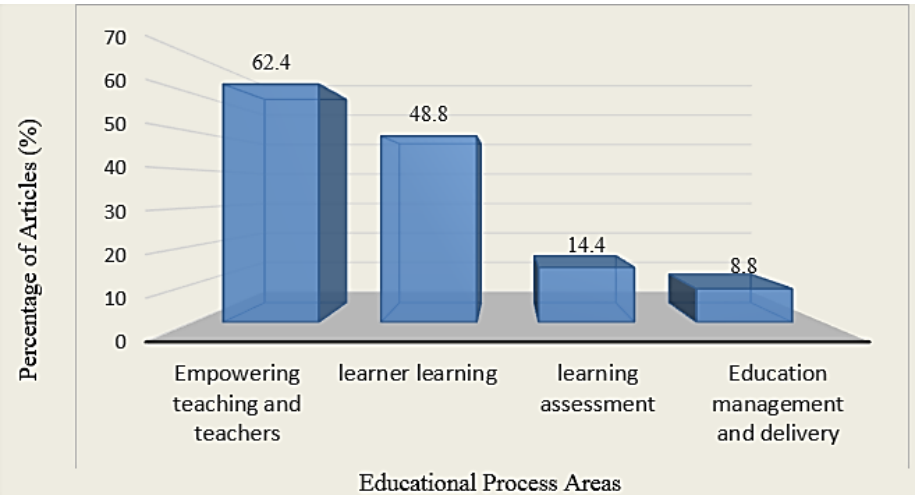

Figure 6. Distribution of AI research in education by educational process areas

This ranking may reflect that improvement processes primarily target human resources competencies; i.e., teachers and learners. This is followed by the assessment process, including the diagnosis of strengths and weaknesses, and follow-up. Finally comes the education management tasks. In detail, the SRAEL has shown that AI applications can positively enhance the areas of the educational process through the following practices:

- Individualization of education or adaptive learning: AI applications can provide personalized educational resources for each student and effectively meet their needs by analyzing data and understanding their learning styles and levels.
- Improving teaching methods: teachers can use AI applications to improve the way they design, deliver, and present lessons, including allocating educational resources, providing personalized guidance to students, delivering effective assessments, and analyzing data to improve educational performance.
- Predictive analytics: smart applications enhance data analysis and predict which students are more likely to fail. These predictive analytics can help teachers identify students facing learning challenges earlier and then support them to succeed.
- Facilitating content presentation: AI algorithms can analyze and summarize big data quickly and accurately. This capability helps students who struggle to read or comprehend long content create condensed versions of lessons that provide concise and quick information.
- Smart content creation: AI tools are used to create smart content from digital textbooks, ensuring personalized digital learning environments with numerous features and customization options.
- Data analysis: AI applications can analyze schools' data to improve resource management and guide decisions more effectively. They can also analyze student performance, identify knowledge gaps, and provide individualized guidance to improve the learning experience and enhance educational efficiency.
- Administrative task automation: AI applications can be used to implement and manage administrative activities and tasks in schools automatically and autonomously. This includes the use of software, smart applications, and learning management systems to automate processes such as lesson scheduling, student assessment, report generation, attendance management, organizing school events, and other administrative activities.
- Feedback: students can improve or change their responses based on immediate feedback on their performance. AI applications thus help analyze student results and provide personalized feedback and guidance to help them improve their academic achievement and enhance their understanding of academic subjects.
- Bridging the skills gap: it is possible to improve the skills of students and teachers by connecting them to real-world experiences. This is achieved by analyzing how people acquire skills. Once the system adapts to human methods of studying and learning, it automates the learning process accordingly.
- Automated grading: AI accurately and efficiently grades essays, tests, and assignments, saving teachers significant time.
- Automated assessment and feedback: smart learning tools can provide detailed reports on student progress and tips for improving academic performance.

- Test preparation: teachers can use AI applications to prepare test questions, assignments, and various exercises. The applications also help analyze student data and then deliver appropriate or customized tests that help students develop their skills.
- Providing secure learning systems: decentralized networks can be created to prevent anyone from accessing stored data without permission, thus limiting unauthorized ones to access to important data, such as grades.
- Exam cheating detection: cheating during exams can be prevented through facial recognition systems or voice analysis software, which verify students' identities and detect suspicious behavior during exams.
- Career guidance; AI applications analyze individual data for each student and provide personalized guidance based on their interests, abilities, and career goals. Schools use these technologies to enhance the learning experience and provide individualized support for each student, helping them make informed decisions about their academic majors and future career paths.
- Social and emotional counselling: using machine learning and data analysis techniques, students' behavior and emotional and social responses can be accurately analyzed in real time. These applications can also identify students who may be experiencing socio-emotional and psychological learning difficulties.

These practices, confirmed by the SRAEL, assert the potential of AI to improve the educational process areas by automating simple tasks and focusing on creating an effective and efficient educational environment that enables students and teachers to leverage AI applications in improving "education management and delivery", "empowering teaching and teachers", "learner learning", and "learning assessment". The SRAEL also demonstrated that AI contributes to providing high-quality education and assists in various matters without completely eliminating the role of teachers. AI systems and applications still require human intervention. While these applications will change many roles, they will also lead to the emergence of new roles necessary for the success of the educational process, which is based on enhancing teachers' capabilities and increasing learner productivity. This fosters the need to make educators and stakeholders aware of the role of implementing AI applications in education.

4.4. Answering the fourth question: to what extent do academic experts agree on the potential of implementing AI practices in the areas of the educational process?

Figure 7 presents the means of practices that enhance AI use in improving the educational process areas, which ranged from 4.35 to 4.78. The SRAEL results were leveraged to extract the practices indicated by the literature. These practices were formulated procedurally in accordance with the criteria for questionnaire construction, and then classified into four educational domains: 11 practices under education management and delivery, 12 under learner learning, 12 under empowering teaching and teachers, and 5 under learning assessment. The opinion poll responses used a five-level scale. Table 1 shows that all experts agreed on the importance of the practices to a very large degree, with percentages exceeding 87%. These responses demonstrate the consistency of academic experts' opinions with the SRAEL results and confirm the positive role of AI applications in the educational process.

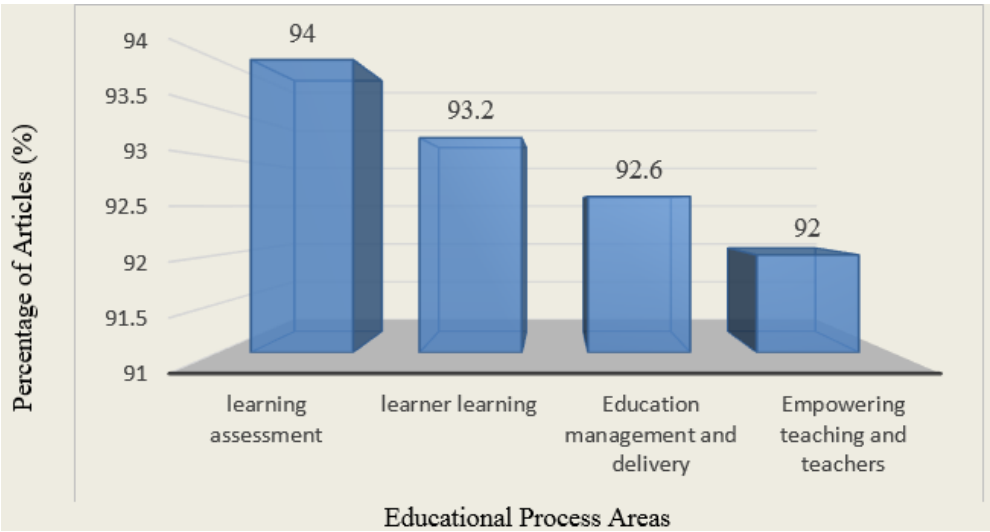

Figure 7. Academics' perceptions of AI applications across educational process areas

Table 1. Academics' agreement degrees on the importance of AI practices in improving education

No	Practices that enhance the use of AI in the educational process	Mean	%
1.	Analyzing and scheduling student academic data.	4.78	95.60
2.	Designing an education management information system to assist in the student admissions process.	4.68	93.60
3.	Creating profiles for each individual student.	4.68	93.60
4.	Using smart systems to analyze students' educational needs.	4.68	93.60
5.	Using smart systems to track student attendance.	4.65	93.00
6.	Using smart systems to respond to student inquiries.	4.65	93.00
7.	Using smart applications to receive and follow up on student assignments.	4.62	92.40
8.	Creating personalized learning paths to meet each learner's preferences and achievements.	4.59	91.80
9.	Using intelligent systems to deliver academic assistance to students.	4.59	91.80
10.	Using intelligent systems to manage dialogues between student groups.	4.51	90.20
11.	Employing AI applications to divide students into learning groups.	4.49	89.80
	Total of practices related to "education management and delivery"	4.63	92.60
12.	Providing adaptive learning systems that take into account individual differences among students.	4.78	95.60
13.	Designing an educational platform to provide an ideal online learning community.	4.73	94.60
14.	Customizing virtual dialogue learning platforms that allow for monitoring and providing feedback on the challenges arising from the use of AI in the learning environment.	4.73	94.60
15.	Employing machine learning techniques to improve student learning and motivate students to engage in the learning process.	4.70	94.00
16.	Supporting course content with multimedia files that address student needs.	4.70	94.00
17.	Leveraging AI techniques to improve language learning skills.	4.70	94.00
18.	Designing online learning activities to accompany course content.	4.68	93.60
19.	Providing adaptive support for students with new AI applications.	4.65	93.00
20.	Creating electronic sub-links between related course topics.	4.59	91.80
21.	Employing virtual reality and augmented reality to support student learning processes, enhance the experience of virtual reality, and address, control, and predict its problems.	4.57	91.40
22.	Using available intelligent systems to monitor student attention in the classroom.	4.54	90.80
23.	Converting course content into scenarios that support student learning and making them available on cloud computing.	4.51	90.20
	Total of practices related to "learner learning"	4.66	93.20
24.	Leveraging AI to reduce teacher academic workloads.	4.76	95.20
25.	Ensuring sustainable support and training to enable teachers to use AI in the learning environment.	4.73	94.60
26.	Providing smart academic technologies and programs to assist in education (language teaching, explaining some practical courses, and solving complex exercises) without a teacher.	4.68	93.60
27.	Using smart learning programs to support private tutoring for students with special needs.	4.65	93.00
28.	Employing smart educational media that takes student learning into action.		
29.	Using smart learning programs that take lessons into account within the curriculum for all students.	4.59	91.80
30.	Providing smart training programs that contribute to the development of learning, education, life, and work skills.	4.59	91.80
31.	Leveraging educational chatbots to provide students with the information and guidance they need.	4.57	91.40
32.	Leveraging AI technologies to provide assistant or private tutors who facilitate students' psychological, academic, and skill-related needs.	4.57	91.40
33.	Leveraging machine learning to help students build cognitive connections and generate new knowledge.	4.57	91.40
34.	Automating dialogue-based teaching systems to simulate spoken educational conversations between teachers and students.	4.49	89.80
35.	Using intelligent learning systems that mimic the performance of human teachers in teaching students.	4.35	87.00
	Total of practices related to "empowering teaching and teachers"	4.60	92.00
36.	Employing new technologies to develop assessment methods that take into account individual learners' needs (e.g., e-portfolios, adaptive and continuous assessment based on AI).	4.76	95.20
37.	Supporting teachers to use AI-based formative assessment.	4.73	94.60
38.	Automating grading and assessment (automated monitoring of student grades within the learning environment).	4.68	93.60
39.	Providing synchronous feedback on student performance and achievement, whether progress or decline, to predict student outcomes and subsequently correct and modify their academic behavior.	4.68	93.60
40.	Using student facial recognition applications with AI systems for user authentication and monitoring in online assessments.	4.65	93.00
	Total of practices related to "learning assessment"	4.70	94.00

5. CONCLUSION

This study systematically reviewed Arab research on the use of AI in education and confirmed the growing scholarly interest in AI-driven educational practices. The findings demonstrated that AI technologies play a significant role in enhancing multiple dimensions of the educational process, including education management and delivery, learner learning, teaching practices, and learning assessment. The review also indicated that AI contributes to improving administrative efficiency, enabling data-informed decision-making, and supporting personalized educational experiences. AI applications also foster learner engagement, motivation, and skill development through adaptive, interactive, and immersive learning environments. In instructional contexts, AI reduces teachers' administrative workload, supports differentiated instruction, and facilitates continuous professional development. Furthermore, AI-based assessment systems enhance evaluation accuracy, provide timely feedback, and enable adaptive formative assessment. Despite

these benefits, the effective integration of AI in education requires careful consideration of equity, ethics, data privacy, and institutional readiness. Ensuring fair access to AI technologies, providing systematic professional development, and redesigning pedagogical and assessment frameworks are essential for sustainable implementation. Overall, AI should be viewed as an enabling and supportive technology that augments, rather than replaces, and the human elements of education. Future research should focus on long-term impacts, context-sensitive implementation models, and the development of robust ethical and governance frameworks for AI in educational systems.

FUNDING INFORMATION

Authors state no funding involved.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

Not applicable. This study did not involve human participants, human data, or any personally identifiable information. All data used were either publicly available, fully anonymized, or derived from non-human sources, and therefore no informed consent was required from individuals.

ETHICAL APPROVAL

Not applicable. This research did not involve human subjects, human biological materials, or experimental procedures on animals. The work was conducted solely on computational models, publicly available datasets, or non-sensitive data that did not require intervention with living organisms. Therefore, ethical approval from an institutional review board or animal ethics committee was not necessary for this study.

DATA AVAILABILITY

The authors confirm that the data supporting the findings of this study are available within the article.

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