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Automation in Education: What AI Offers for Arabic Language Learning

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ABSTRACT: The 21st century has witnessed rapid advancements in educational technology, particularly with the advent of Artificial Intelligence (AI). In Arabic language education, AI has created opportunities to automate several aspects of learning, including vocabulary practice, grammar feedback, translation, writing support, pronunciation assistance, and conversational activities. These developments are particularly relevant to Arabic because its morphological complexity and linguistic variation present distinctive challenges for both learners and educational technologies. However, the increasing use of AI also raises questions about the accuracy of generated Arabic, learner dependency, teacher readiness, and the extent to which automated systems can respond appropriately to linguistic and cultural contexts. This paper aims to study the fundamental of artificial intelligence and analyse to what extend the artificial intelligence benefits learning of Arabic language. Drawing on recent research on AI-assisted language learning, the discussion indicates that AI can extend learning opportunities beyond the conventional classroom and provide learners with more flexible and responsive forms of practice. Findings also suggest that intelligent tutoring systems, Natural Language Processing (NLP), and related AI technologies can facilitate personalised diagnosis and the recommendation of learning materials. Recent Arabic-focused research further indicates that AI can support vocabulary development, grammar practice, pronunciation, and guided interaction, although limitations in accuracy and linguistic nuance remain. Overall, AI offers substantial potential for automating routine learning support, but its educational value depends on effective teacher mediation and purposeful pedagogical integration.

KEYWORDS: artificial intelligence, automation in education, Arabic language learning, challenges in AI application.

INTRODUCTION

The emergence of the 21st century is adorned with rapid advancements in science and technology that aimed at simplifying human daily activities from various aspects (Salbihana et al., 2023). The invention of Internet at the end of the 20th century sparked the eruption of information and communication technology thereafter. Artificial intelligence (AI) technology which was developed based on the existence of the internet, has become a manifestation of rapid and continuous development of information technology in this era (Shabbir & Anwer, 2015). While the invention of the internet provides humans with fast and easy access to information, the creation of artificial intelligence (AI) offers more extensive assistance by taking over most human roles, especially those involving cognitive activities such as remembering, generating information, processing data, and producing new outputs based on previous information (Ni Luh Putu & Putu Trisna, 2020; Shabbir & Anwer, 2015).

According to Altowayti (2022), the artificial intelligence system refers to a mechanism or process that simulates human intelligence processes using machines, specifically computers. It refers to the ability of computer machines or robots to perform roles that are the same or nearly the same as humans (Shabbir & Anwer, 2015; Neisser et al., 1996). Several processes contribute to the learning process, such as learning (the acquisition of information and rules for using it), reasoning (application of the rules to reach approximate or definite conclusions), and self-correction (Rasool et. al., 2023). This technology has numerous applications, such as enhancing the efficiency of tasks and processes, as well as creating more accurate and reliable results. The implementation of artificial intelligence, specifically in the academic world can facilitate the automation of repetitive and tedious tasks in classroom teaching and learning process, thus leading to cost and time savings. Additionally, AI can be used to make predictions about future events and identify patterns in the data for the purpose of future predictions (Kong, 2013). This can benefits students by practising independent study without close monitoring by their lecturer.

The similar phenomenon occurs in Arabic language education where Artificial Intelligence (AI) has transformed educational practices and created new challenges and opportunities for language learning environment. According to Anjum et al. (2015), Arabic language as a core subject in Islamic education faces increasing pressure to adapt to digital technology and AI-driven learning environment. That is because, experts see AI capable of enhancing students' engagement through interactive learning platforms that foster active participation. Currently, there are numerous AI tools available for language teaching and learning that are universal for all languages. Despite this positive development, languages such Arabic still facing tough challenges especially in terms of tools compatibility with Arabic writing system that may affects the integrity of the tools. For example, the tool such as virtual tutoring application powered by AI offers students personalized feedback and assistance, making learning more accessible and responsive to individual needs. In term of Arabic learning, a question arises on how accurate AI analyses data in Arabic script how credible AI feedback from users' prompt.

PROBLEM STATEMENT

In the education field, it is undeniable that AI plays a very important role, especially in the aspect of teaching and learning (Ayah, 2023). According to Al-Mahdi (2021), the adaptation of AI in the teaching process helps educators face current challenges in education. In language education, these capabilities in AI application will benefit language learning, where vocabulary, syntax, and comprehension must be coordinated in real time (Alhusaiyan, 2025). AI-powered self-learning tools that may range from intelligent tutoring systems and adaptive drills to language-rich chatbots (Alhusaiyan, 2025) and reading analytics dashboards (Luis Cabral et al., 2025); offer specific diagnostics of reader profiles in adjusting text difficulty in accordance with these profiles, scaffolding strategies, and feedback to match current competencies of users (Gao, 2023; Mahendra & Anil, 2026). This learning tool can enhance learning engagement by presenting appropriately challenging texts, providing live feedback, and fostering self-regulated practice patterns that extend learning beyond the classroom (Kazi Bushra et al., 2026). Experts also assure efficiency gains for educators and scalable access to high-quality learning material experiences by learners, particularly in contexts with limited specialist instruction or diverse learner populations (Gao, 2023; Rachel Gugu & Oluwatoyin, 2024).

However, engaging AI in Arabic language education is comparably problematic compared to other languages. There are two major hurdles that hinder this field of Arabic language teaching. Firstly, in terms of technicality where Arabic language is known for its complexity. Khalati and Al-Romany (2020), assumed that the language characteristics which create challenges to Arabic text processing for artificial intelligence are, first, it includes many rules and symbols of various meaning that differ with change of tones, character, and punctuation marks, second, synonymy is a present of more than one word in a difference form. Likewise, metonymy means a word with multiple meanings that are known through contexts and clues. There are other issues that make Arabic language is a problematic for automatic analysing such as rich of morphology that inflected by number, gender, voice, and case. Besides, the language uses diacritics writing system that donate the short vowels which not consistently using it (Ibrahim Badr *et. al*., 2008).

Secondly, studies have shown that level of Arabic language nowadays among students at various levels of education, especially in universities, is facing serious problems. They face more critical problem particularly in language skills aspect. According to Mohd Hazli and others (2019), reading skills are among the main issues faced by students at the school and university levels. However, problems with writing and speaking skills are also prominent. A study conducted by Nur Zafirah (2011) has proven that students in this field at universities level are struggling to keep up with their studies. Among the scrutinised causes are a lack of critical Arabic vocabulary mastery and its importance roles in sentence contexts and situations (Nadwah & Nadhilah, 2014). According to Rahimi et al. (2014), the current issue is that students lack sufficient and appropriate vocabulary for their level of studies. The learning process of Arabic language through AI may face difficulty because of these weaknesses.

OBJECTIVE OF THE STUDY

This qualitative study aims to achieve these objectives:

1. To study the fundamental of artificial intelligence in Arabic language learning.
2. To analyse to what extend the artificial intelligence benefits Arabic language learning.

METHODOLOGY

This study adopts a qualitative research design through a library and document analysis approach to obtain data, examine relevant content, and synthesise information related to the research topic in detail. Both primary and secondary sources, available in digital and physical formats, were analysed. These sources include academic writings, official ministry documents, books, journals, articles, official reports, and other relevant materials. The collected data were examined and synthesised to develop a comprehensive understanding of the issues addressed in the study. A deductive approach was implemented to reach to a concrete conclusion. According to Mohamad Najib (1999), the deductive approach in research involves a pattern of reasoning that moves from general information to specific conclusions. Accordingly, this approach is considered appropriate for the present study because it facilitates a systematic examination of a systematic review of AI in Arabic language learning.

THE EMERGENCE OF AI IN EDUCATION

Artificial Intelligence or AI refers to the ability of computer machines or robots to perform roles that are the same or nearly the same as humans (Shabbir & Anwer, 2015; Neisser *et al.*, 1996). According to the European Commission (2020), AI is a combination of modern technologies that integrate data, algorithms, and computer sophistication. In other words, AI is used to develop robots capable of mimicking human characteristics, behaviour, learning from past experiences, sensing, making predictions, and understanding different situations through a vast amount of input data (Dignum, 2021; Al-Sa'id *et al*., 2019). The sophistication of AI at present is at a very high level with its abilities such as planning, scheduling, exploring, and presenting information; as well as the robotic capabilities that serve as guards, sensors, perception, actuators, and physical component integration (Dignum, 2021).

According to Dignum (2021), some of the general advantages of AI include fostering critical thinking among students, problem-solving skills, and group collaboration. Therefore, the suitability of AI for this course is not limited to teaching aspects but also in generating student activities, whether individual or group-based, and providing training exercises with answers (Alam, 2021). Teachers only need to monitor student learning activities from a distance or virtually (Muhammad & Herdi, 2022).

According to the views of Shabbir & Anwer (2015), AI has an ability to learn from past experiences like humans and thus help improve the standard of living over the time. According to them, AI will be used more extensively in the future in almost all sectors such as finance, medicine and healthcare, customer service, education, defence, aerospace, and others (Shabbir & Anwer, 2015; Dignum, 2021). Meanwhile, Wong & Bressler (2016) add other sectors such as the music industry and gaming. In the financial sector, for example, AI greatly assists in human daily operations such as customer service, finance, sales and marketing, and financial management (Shabbir and Anwer, 2015).

Although these advantages of AI application in human life, its emergence in education is somehow not straight forward. Some experts and practitioners are reluctant to embrace the widespread use of AI in education. The issue of AI integrity becomes one of the popular topics in

education on how far AI can be accountable for making decisions on behalf of humans (Dignum, 2021). In line with this question, Ayah (2023) remarks that education community need proper guidelines that can show the best practices on how to benefit from AI. Education experts at the same time, are requested to identify boundaries on the use of AI without sacrificing the main objective of education. According to him, the accountability and responsibility aspects of AI are not limited to the formulation of laws governing its use but are also related to the roles of society and institutions that utilise it (Dignum, 2021).

1. Ai In Arabic Language Learning

As a matter of fact, teaching had been practiced from long time ago and its methodology evolved over the time. Historically, before the digital era, traditional teaching methods inherited from ancient scholars and educational practitioners were primarily based on memorisation and understanding of lessons, as well as teacher-centred approaches such as lectures and reliance on textbooks (Norazlin & Siti Rahaimah, 2019). Before the advent of artificial intelligence (AI) technologies in education, traditional teaching methods were deeply rooted in centuries-old practices. These methods emphasized direct teacher instruction, manual writing, rote memorization, and limited access to resources. The classroom environment of the past, with its structured seating arrangements and reliance on physical textbooks, fostered different kinds of learning experiences and challenges than those seen today. Generally, without the educational technology, teachers and students before the digital era, rely solely on formal classes and language activities held in school.

The emergence of Artificial Intelligence (AI) in Arabic language education is closely connected to the broader movement towards digital and personalised learning. From the mid-2010s, AI began to receive increasing attention in education as technologies such as intelligent tutoring systems, automated assessment, speech recognition, and adaptive learning became more developed. These technologies offered new ways of responding to learners' individual needs while providing greater flexibility in the learning process (Luckin et al., 2016). In Arabic language education, the development of AI has been influenced by the characteristics of the Arabic language. Its rich morphological structure, together with the coexistence of Classical Arabic, Modern Standard Arabic, and various dialects, presents significant challenges for computational language processing. Nevertheless, substantial progress has been made in Arabic Natural Language Processing (NLP), particularly in areas such as language analysis, machine translation, sentiment analysis, and transliteration (Guellil et al., 2021).

The arrival of generative AI, especially with the emergence of ChatGPT in late 2022, has further changed the possibilities for Arabic language learning. AI tools can now assist learners with vocabulary, writing, translation, conversation practice, and immediate feedback. At the same time, their use requires careful consideration of accuracy, academic integrity, overreliance, and data privacy. UNESCO (2023) therefore advocates a human-centred approach in which generative AI is introduced through appropriate ethical safeguards and sound pedagogical practices. Accordingly, AI is more appropriately understood as a tool that complements the Arabic language teacher rather than replaces the teacher. Its educational contribution ultimately depends on how thoughtfully teachers and institutions incorporate it into meaningful language-learning activities.

2. Challenges In Arabic Language Learning Through Ai

The use of Artificial Intelligence (AI) in Arabic language education presents promising possibilities, but its integration is far from straightforward. One of the main difficulties stems from the linguistic characteristics of Arabic itself. The language has a complex morphological and syntactic structure and is used across different varieties, including Classical Arabic, Modern Standard Arabic, and regional dialects. These differences create difficulties for AI systems that are expected to understand and generate Arabic accurately across different contexts. Research in Arabic Natural Language Processing (NLP) has consistently highlighted the challenges associated with linguistic variation and the availability of suitable computational resources.

The accuracy of AI-generated Arabic is another important concern. Although large language models can produce fluent and convincing responses, fluency should not be confused with linguistic correctness. Khondaker et al. (2023), in their extensive evaluation of ChatGPT across Arabic NLP tasks, found that its performance varied across tasks and language varieties. They also reported that ChatGPT and GPT-4 performed less effectively with dialectal Arabic than with Modern Standard Arabic in several aspects of their evaluation. For Arabic language learners, this limitation is particularly significant because students may not yet have the linguistic knowledge needed to identify an inaccurate translation, inappropriate expression, or grammatical error.

A related problem concerns the availability and representation of Arabic language data. AI systems depend heavily on the quality and diversity of the data used to develop and evaluate them. When dialects, registers, or communicative contexts are inadequately represented, the resulting systems may not respond equally well to all learners. This issue is especially relevant to Arabic because learning often involves movement between formal written Arabic and spoken varieties. There are also important pedagogical and ethical considerations. Easy access to generative AI may encourage students to use it to produce translations, written assignments, or answers rather than engage directly with the language-learning process. Excessive dependence could therefore weaken opportunities for independent writing, vocabulary development, and critical evaluation. At the institutional level, questions surrounding academic integrity, privacy, equitable access, and responsible use also require attention. UNESCO (2023) emphasises that generative AI should be introduced through a human-centred approach that protects human agency, promotes equity, respects linguistic and cultural diversity, and incorporates appropriate safeguards for data privacy.

Therefore, teachers and educators need sufficient knowledge to use AI critically rather than simply technically. Effective integration requires teachers to evaluate AI-generated content, recognise its limitations, design meaningful learning activities, and guide students towards responsible use. In Arabic language education, therefore, the central issue is not whether AI should be used, but how it can be incorporated without compromising linguistic accuracy, learner independence, academic integrity, or the teacher's pedagogical role.

3. Integrity Issues In Ai Application For Arabic Language Education

Based on previous discussion, the integrity issues of AI applications in education primarily and Arabic language particularly, revolve around concerns related to ethics, data privacy, bias, transparency, and accountability. It is a central concern in the application of AI to Arabic language education. Generative AI can produce translations, essays, grammatical explanations, and other learning materials with minimal student input, creating difficulties in determining authorship and genuine language proficiency. Such use may encourage academic dishonesty, particularly

when students submit AI-generated work as their own. Yeo (2023) notes that AI writing tools raise significant questions concerning authorship and academic integrity. In Arabic learning, the problem is further complicated by the possibility of inaccurate or inappropriate linguistic output being accepted without verification. Here are some points of integrity matters related to these issues:

1. Data Privacy and Security: AI systems require access to large amounts of data, including personal information about students and educators. Ensuring this data is collected, stored, and utilized securely is critical. Breaches or misuse of sensitive information can undermine trust and violate privacy regulations (e.g., FERPA in the U.S.).
2. Bias and Fairness: AI systems can inadvertently perpetuate or amplify existing biases if they are trained on biased datasets. This can lead to unfair treatment of students based on race, gender, socioeconomic status, or disability. It's essential to continually audit AI algorithms for bias and implement corrective measures.
3. Transparency and Explainability**:** AI models, especially those based on deep learning, can act as "black boxes," making their decision-making processes opaque. Educators, students, and parents need to understand how and why decisions are made, particularly in high-stakes situations such as admissions, grading, or personalized learning paths.
4. Academic Integrity**:** The use of AI in educational settings raises concerns about cheating and plagiarism. For example, AI-generated content may make it easier for students to submit work that is not their own. Institutions must develop strategies to uphold academic integrity while leveraging AI tools.
5. Dependence on Technology: Over-reliance on AI tools can lead to a decrease in critical thinking and problem-solving skills among students. It's essential to balance technology use with traditional teaching methods to ensure holistic development.
6. Access and Equity: The implementation of AI can exacerbate existing inequalities in education, as students in underfunded schools may not have the same access to advanced AI tools as those in wealthier institutions. Ensuring equitable access is crucial for the overall integrity of educational applications.
7. Accountability: There is often confusion about who is responsible when AI systems make harmful or erroneous decisions. Clear frameworks need to be established to determine accountability, particularly if a student is adversely affected by these decisions.

WHAT AI OFFERS TO ARABIC LANGUAGE LEARNERS

The incredible ability of AI mentioned above seemed able to demolish and replace the traditional method of teaching and consequently ignites the clash between both. It is undeniable fact that the advent of AI in recent years has bring a 360-degree shift in education in all aspects. It caused a total revamp of traditional method of teaching. The discussion above describes how teaching and learning process was performed traditionally before the AI era. According to Dignum (2021), the sophistication of AI at present is at a very high level with its abilities such as planning, scheduling, exploring, and presenting information; as well as the robotic capabilities that serve as guards, sensors, perception, actuators, and physical component integration. These abilities trigger those changes in traditional teaching methods where they can be elaborated as follows:

1. Intelligent Tutoring Systems (ITS)

These systems simulate one-to-one tutoring by diagnosing learners' strengths and weaknesses and adapting instructional content accordingly. ITS collect data from learners to form individualised profiles and models tailoring content to each learner's need and progress (Alhusaiyan, 2024). They adapt item difficulty, sequencing, and feedback in real time. Over time, the ITS system is not only modelled by learner knowledge, but other characteristics such as learning style, activities and affect states contribute to form system personalised respond (Gao, 2023) Such systems have demonstrated effectiveness in improving learner engagement and achievement because they adjust the level of difficulty according to learners' performance. In language learning, ITS can provide grammar explanations, vocabulary practice, and comprehension exercises tailored to individual needs.

2. Natural Language Processing (NLP)-based tools

These tools enable computers to understand, process, and generate human language (Hu, 2024). In language education, NLP supports grammar checking, vocabulary enhancement, automated text summarisation, machine translation, sentiment analysis, and text simplification (Khazri Osman et al., 2025). Applications employing NLP allow learners to receive immediate corrective feedback on grammatical errors, lexical choices, and sentence structures, thereby promoting self-directed learning. NLP technologies form the foundation of many contemporary language learning applications by enabling meaningful interaction between learners and computer systems.

3. Automatic Speech Recognition (ASR) tools

They represent another significant advancement, particularly for speaking and pronunciation practice. ASR converts spoken language into text and evaluates pronunciation accuracy, fluency, and speech clarity. Learners can repeatedly practice speaking while receiving immediate feedback without requiring a human instructor. Research indicates that ASR technology contributes positively to pronunciation development, speaking confidence, and oral fluency, especially in second-language learning environments. Modern language-learning applications increasingly integrate ASR to facilitate autonomous speaking practice.

4. Generative AI (GenAI)

This tool further expanded opportunities for language learning. GenAI can generate human-like text, simulate authentic conversations, answer learners' questions, explain grammar, create writing prompts, and provide personalized feedback on written assignments. These capabilities enable learners to engage in contextualized language practice that resembles interaction with a human tutor (Khazri Osman et al., 2025). Furthermore, generative AI supports task-based learning by producing dialogues, role-play scenarios, summaries, and customized language learning materials appropriate to learners' proficiency levels. However, educators should encourage critical evaluation of AI-generated content because occasional factual or linguistic inaccuracies may occur.

5. AI-powered conversational agents and chatbots

They facilitate interactive language practice through real-time dialogue. These systems simulate authentic communication by responding to learners' inputs in natural language. Natural language understanding (NLU) and generation (NLG) enable adaptive dialogue that challenges

learners with higher-order questions as their proficiency level grows (Mahendra & Anil, 2026). Chatbots promote communicative competence by providing opportunities to practice conversation in low-anxiety environments where student can progress themselves at their own pace (Kazi Bushro et al., 2026). They are particularly valuable for developing speaking and writing skills, increasing learner motivation, and supporting self-paced learning. Recent conversational AI systems integrate NLP, ASR, and generative AI to create increasingly realistic language-learning experiences. Among these chatbots that are available are talkpal, Copycat Café, learna AI and many more.

6. *Content-generation and Retrieval-Augmented Tools*

These tools operate by pulling data from established corpora to assemble authentic or pedagogically designed texts at a chosen level of difficulty. They embed guided questions, activities, and linguistic notes, then adjust discourse complexity based on the learner's performance (Khazri Osman et al., 2025). AI can also simulate authentic language tasks in various genre of materials with embedded comprehension checks and reflection prompts, supporting transfer of language skill strategies to real-world materials. For example, AI systems that adapt or generate reading passages and questions on demand, using retrieval-augmented generation to tailor texts to learner interests and cultural context.

Overall, AI is transforming teaching from a one-size-fits-all model to a more personalized, data-driven, and technologically enhanced approach that aims to improve learning outcomes and the student experience.

THE PROSPECT OF AI EDUCATION

The future of AI in education holds promising advancements in adaptive learning, providing even more customized educational experiences based on real-time data. AI-driven global collaboration may facilitate cross-cultural exchanges and broaden educational horizons. In the long term, AI's role in education is expected to significantly improve educational outcomes, equipping students with the knowledge and skills needed to thrive in an increasingly digital world.

Artificial Intelligence (AI) is opening new possibilities for Arabic language education, particularly as advances in Natural Language Processing (NLP) and large language models continue to improve the way machines process and generate language. The prospects are especially noteworthy for Arabic, a language characterised by a complex morphological system and considerable variation between Classical Arabic, Modern Standard Arabic, and regional dialects. Although these characteristics have traditionally presented difficulties for computational processing, developments in Arabic NLP are gradually expanding the range of resources and applications available for language learning and teaching (Guellil et al., 2021).

One particularly promising area is personalised language learning. AI-based systems can potentially adapt vocabulary exercises, grammar explanations, reading materials, and writing activities to learners' proficiency levels and individual needs. Rather than providing the same materials to every student, such systems can support more flexible learning pathways and offer immediate responses to learners' questions and errors. The AI-assisted personalised language learning can draw on technologies such as intelligent tutoring systems and NLP to support learner diagnosis, personalised learning paths, and the selection of appropriate learning resources.

Muhammad & Herdi (2022) see specific AI applications such as Intelligent Tutoring Systems (ITS), Voice Assistants, Personalized Learning, Virtual Mentors, Smart Content, Automatic Assessment, and Educational Games can be implemented in teaching Arabic morphology. For example, the Smart Content application, which can make predictions based on past experiences and inputs, is suitable for word formation exercises based on patterns for students. Meanwhile, Automatic Assessment helps teachers conduct quizzes and tests more effectively and practically via online. Voice Assistant applications help students to learn independently about pronunciation differences in words that have the same spelling but different patterns.

The future of AI in Arabic language education, therefore, should not be understood simply in terms of replacing conventional teaching. Its greater value lies in extending what teachers and learners can do. With continued improvements in Arabic language models, better representation of dialects, and carefully designed pedagogical applications, AI has the potential to make Arabic learning more personalised, interactive, and accessible while retaining the essential role of teachers in guiding the learning process.

CONCLUSION

The prospects of Artificial Intelligence in Arabic language education are considerable, particularly as advances in Natural Language Processing and intelligent learning technologies continue to expand the possibilities for personalised and interactive instruction. AI can support learners by adapting learning materials to individual needs, providing immediate feedback, facilitating language practice, and creating opportunities for learning beyond the classroom. Research on personalised language learning confirms the growing role of AI, particularly through intelligent tutoring systems, NLP, learner profiling, and adaptive resource recommendation. At the same time, the future development of AI for Arabic requires sustained attention to the linguistic characteristics of the language. Its morphological richness and the diversity of Arabic varieties remain important considerations in developing effective computational tools.

Recent work on Arabic language models suggests that greater sensitivity to dialectal variation is becoming possible, which may broaden the usefulness of AI for authentic Arabic learning and communication. Ultimately, the value of AI in Arabic language education will depend less on technological capability alone than on how effectively it is integrated into pedagogy. AI should complement educators' linguistic knowledge and professional judgement rather than displace them. With appropriate instructional design, reliable Arabic resources, and continued technological development, AI can become a valuable means of making Arabic language learning more flexible, responsive, and accessible.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest

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