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Artificial Intelligence in Arabic Language Learning: A Systematic Literature Review of Educational Trends and Future Directions

الذكاء الاصطناعي في تعلُّم اللغة العربية: مراجعة منهجية للأدبيات حول الاتجاهات التربوية والتوجهات المستقبلية

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ABSTRACT

Traditional pedagogical methods in Arabic language instruction often suffer from a lack of interactivity and rigidity, failing to adapt to the individual linguistic needs of non-native speakers. This study aims to synthesize existing research on AI-driven pedagogical strategies to evaluate how these technologies enhance personalization, interactive engagement, and overall language acquisition effectiveness. This review employs a systematic literature search across databases including Scopus, Google Scholar, and DOAJ, covering scholarly publications from 2016 to 2025 to identify and synthesize peer-reviewed interventions. The analysis framework utilizes AlAfnan's Taxonomy of Educational Objectives to categorize AI impacts across cognitive, affective, and psychomotor domains. The synthesis reveals that AI integration significantly improves learner motivation and language proficiency through adaptive feedback and personalized learning platforms. Furthermore, these technologies facilitate the development of core linguistic competencies, including grammar acquisition and speaking practice, while simultaneously fostering character traits such as discipline and responsibility through technology-mediated interactions. Despite these advancements, the findings also underscore a critical reliance on human instructors for navigating the nuanced cultural-contextual complexities inherent in the Arabic language.

The study underscores that while AI-driven tools provide essential support for morphological and semantic challenges, successful implementation requires a balanced integration of automated systems and human pedagogical guidance.

Keywords: Artificial Intelligence; Arabic Language Learning; Personalized Education; Educational Technology; Linguistic Competency.

مستخلص البحث

غالبًا ما تعاني الأساليبُ التربويةُ التقليديةُ في تعليم اللغة العربية من ضعف التفاعل والجمود، مما يحدُّ من قدرتها على التكيُّف مع الاحتياجات اللغوية الفردية للناطقين بغير العربية. يهدف هذا البحث إلى استعراض وتحليل البحوث الحديثة المتعلقة بالاستراتيجيات التربوية المدعومة بالذكاء الاصطناعي، وذلك لتقييم مدى إسهام هذه التقنيات في تعزيز التعلُّم المخصَّص، وزيادة التفاعل التعليمي، وتحسين فاعلية اكتساب اللغة بوجه عام. وتعتمد هذه المراجعة على منهجية المراجعة المنهجية للأدبيات العلمية من خلال البحث في عدد من قواعد البيانات الأكاديمية، بما في ذلك سكوبس(Scopus) ، وجوجل سكولار(Google Scholar) ، ودليل الدوريات مفتوحة الوصول(DOAJ) ، لتغطية المنشورات العلمية الصادرة خلال الفترة الممتدة من عام ٢٠١٦م إلى عام ٢٠٢٥م، بهدف تحديد الدراسات المحكمة وتحليلها وتركيب نتائجها. ويستند إطار التحليل إلى تصنيف العفنان للأهداف التعليمية من أجل تصنيف آثار الذكاء الاصطناعي في المجالات المعرفية والوجدانية والمهارية. وتُظهر

نتائج المراجعة أن دمج تقنيات الذكاء الاصطناعي يُسهم بصورة ملحوظة في تعزيز دافعية المتعلمين وتنمية كفايتهم اللغوية من خلال التغذية الراجعة التكيفية ومنصات التعلُّم الشخصية. كما تُسهم هذه التقنيات في تطوير الكفايات اللغوية الأساسية، بما في ذلك اكتساب القواعد النحوية وتنمية مهارات التحدث، فضلًا عن تعزيز بعض السمات الشخصية، كالانضباط وتحمل المسؤولية، عبر التفاعلات التعليمية المدعومة بالتكنولوجيا. وعلى الرغم من هذه التطورات، تؤكد النتائج أهمية الدور المحوري للمعلم البشري في التعامل مع التعقيدات الثقافية والسياقية الدقيقة الكامنة في اللغة العربية.
ويشير البحث إلى أنه، على الرغم من أن الأدوات المدعومة بالذكاء الاصطناعي توفر دعمًا مهمًا في مواجهة التحديات الصرفية والدلالية، فإن التطبيق الفاعل لهذه التقنيات يتطلب تحقيق تكامل متوازن بين الأنظمة الذكية الآلية والتوجيه التربوي البشري.

الكلمات المفتاحية: الذكاء الاصطناعي؛ تعلُّم اللغة العربية؛ التعلُّم المخصَّص؛ تكنولوجيا التعليم؛ الكفاية اللغوية.

INTRODUCTION

The rapid advancement of Artificial Intelligence (AI) has transformed educational practices across various disciplines, including language learning. (Ulfa, 2023), (Pradana Wisesa & Oka Prawira Wijanarko, 2025) AI technologies such as machine learning, (Mukhamediev et al., 2022) natural language processing (NLP), intelligent tutoring systems, chatbots, speech recognition systems, and adaptive learning (Pradana Wisesa & Oka Prawira Wijanarko, 2025) platforms have increasingly been integrated into educational environments to enhance teaching effectiveness and learner engagement. (Madjid, 2022) In language education, AI provides personalized learning experiences, immediate feedback, automated assessment, and interactive communication opportunities that were previously difficult to achieve through conventional instructional approaches.

The integration of AI into foreign language learning has attracted significant attention from researchers and educators worldwide. (Duaa Hussein Sahi, 2025) Numerous studies have demonstrated the potential of AI to support vocabulary acquisition, grammar learning, pronunciation improvement, writing development, and language assessment. (Badri & Susyla, 2025) The emergence of generative AI tools such as ChatGPT, Google Gemini, and other large language models has further accelerated the adoption of AI in language education by enabling more natural and context-sensitive interactions between learners and digital systems.

Within the context of Arabic language learning, the application of AI presents both opportunities and challenges. (Oktari et al., 2025) Arabic is considered one of the most linguistically complex languages due to its rich morphology, diglossic nature, diverse dialects, and unique writing system. (Madwi, 2025) These characteristics create

difficulties for both learners and technology developers. (Fahmi & Syifaul Adhimah, 2024) Consequently, AI-powered educational solutions for Arabic language learning require specialized linguistic processing capabilities that differ from those designed for other languages such as English.

In recent years, educational institutions have increasingly adopted AI-based technologies to facilitate Arabic language instruction. (Hasanah & Rufaiqoh, 2025) Applications include intelligent tutoring systems, automated writing evaluation tools, speech recognition software for pronunciation practice, virtual learning assistants, chatbot-based conversation training, and adaptive learning platforms. (Rufaiqoh et al., 2024) These technologies aim to improve learning outcomes, increase learner autonomy, and provide more personalized educational experiences. (Rufaiqoh et al., 2024)

Despite the growing body of research on AI-assisted Arabic language learning, existing studies remain fragmented across different educational contexts, technological approaches, and learning objectives. (Rufaiqoh et al., 2024) Some studies focus on technological development, while others investigate pedagogical effectiveness or learner perceptions. This fragmentation makes it difficult to obtain a comprehensive understanding of current research trends and future directions in the field.

Furthermore, the recent emergence of generative AI technologies has created new possibilities and challenges that have not yet been comprehensively synthesized within the Arabic language learning literature. (Yolla Yulia Astuti Y, Farida, 2021) Questions remain regarding the effectiveness, ethical implications, pedagogical integration, accessibility, and long-term impact of AI technologies on Arabic language education. (Cong et al., 2026)

Therefore, a systematic literature review is necessary to consolidate existing knowledge, identify dominant research trends, evaluate educational outcomes, and explore future research opportunities. By systematically analyzing published studies, this review seeks to provide a comprehensive overview of how AI has been utilized in Arabic language learning and to highlight areas requiring further investigation.

RESEARCH METHOD

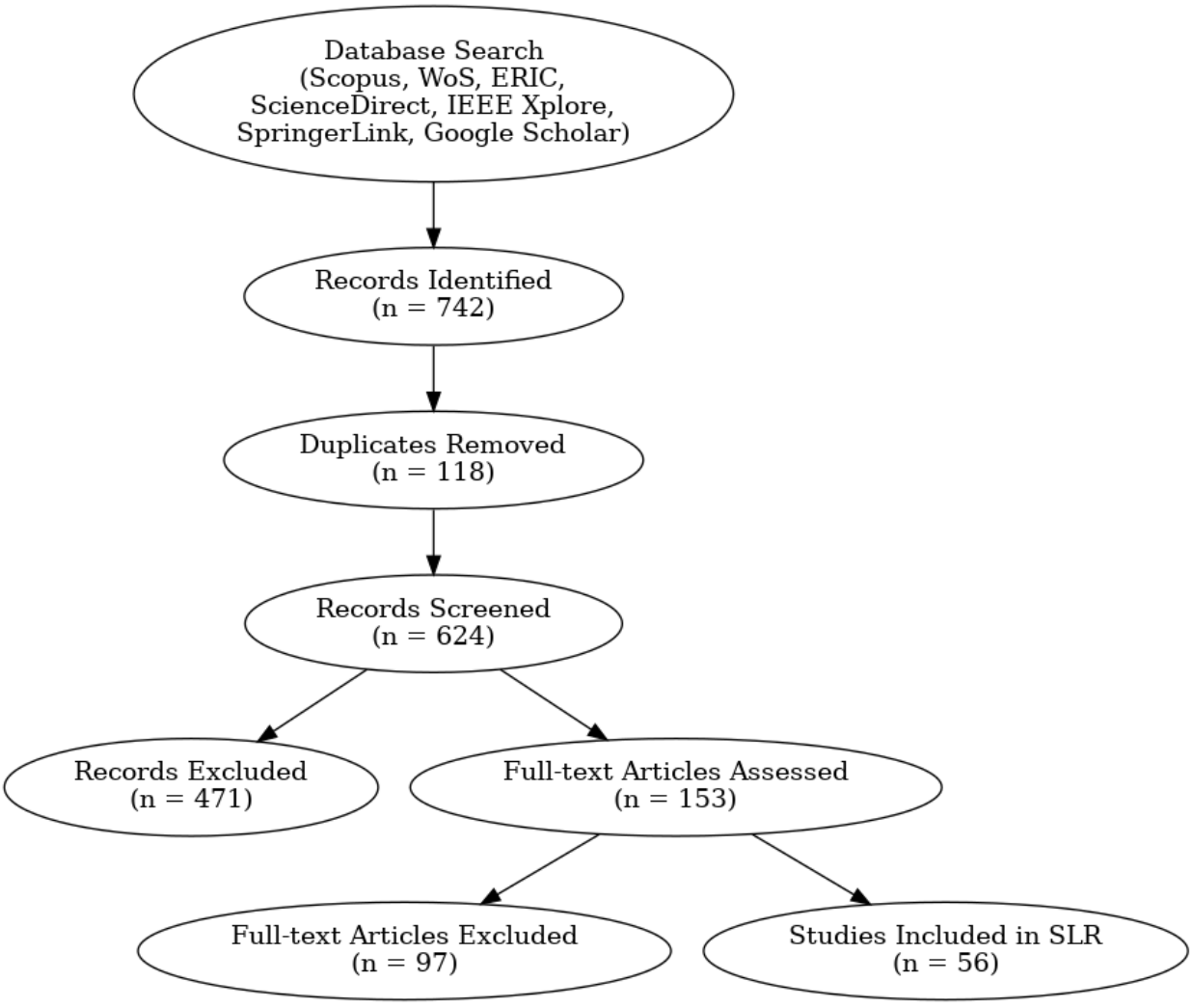
Research Design

This study employed a Systematic Literature Review (SLR) design to comprehensively investigate the application of Artificial Intelligence (AI) in Arabic language learning. (K. M. A. Ahamed ZUBAIR, 2026) A systematic literature review was

selected because it enables researchers to identify, evaluate, synthesize, and interpret existing evidence related to a specific research topic through a transparent and replicable process. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological rigor, transparency, and consistency throughout the study. (Mohebbi, 2025) The SLR approach was considered appropriate because research on AI in Arabic language learning has expanded rapidly in recent years, resulting in diverse findings, methodologies, and technological implementations that require systematic synthesis. By applying the PRISMA framework, this review aimed to minimize selection bias, enhance reliability, and provide a comprehensive overview of current educational trends and future research directions.

Data Sources and Search Strategy

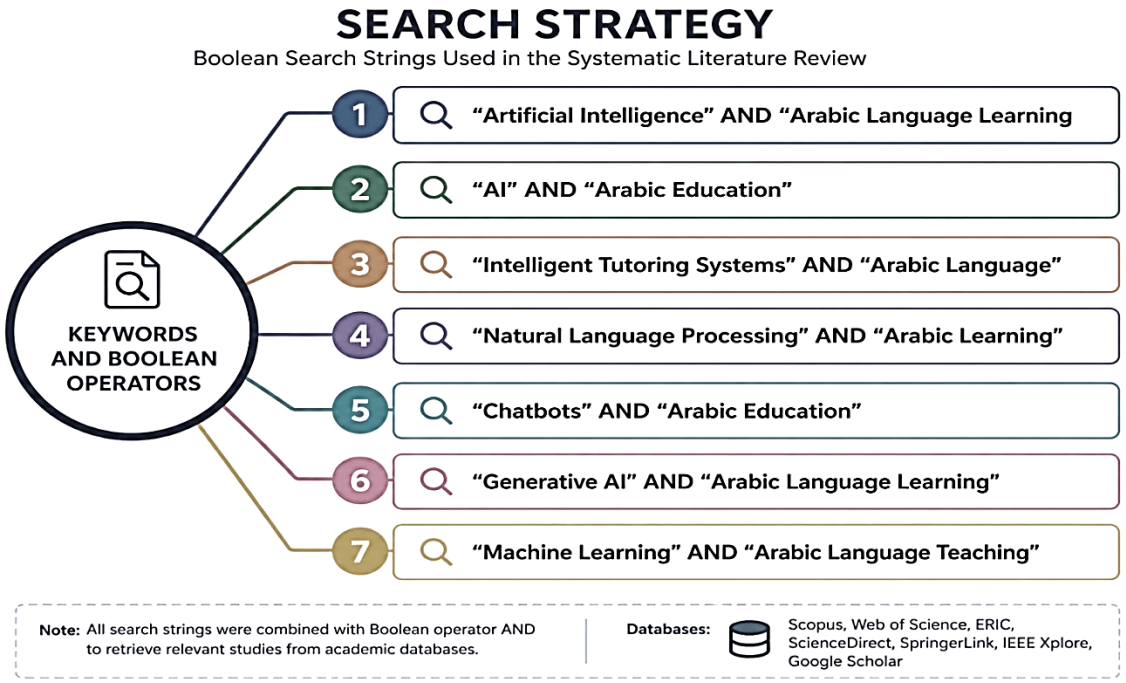
The literature search was conducted across several internationally recognized academic databases, including Scopus, Web of Science (WoS), ERIC, ScienceDirect, SpringerLink, IEEE Xplore, and Google Scholar.



These databases were selected because they contain high-quality publications in the

fields of educational technology, language education, artificial intelligence, and applied linguistics. The search process covered studies published between 2015 and 2025, reflecting the period during which AI technologies experienced substantial growth and adoption in educational settings.

To identify relevant publications, a combination of keywords and Boolean operators was employed. (Mohebbi, 2025) The search strings included:



The search strategy was designed to capture a broad range of studies addressing technological applications, pedagogical innovations, learner outcomes, and emerging AI-based educational practices within Arabic language learning contexts.

Inclusion and Exclusion Criteria

To ensure relevance and quality, studies were selected based on predefined inclusion and exclusion criteria. Studies were included if they: (1) focused on the application of AI technologies in Arabic language learning or teaching, (2) were published in peer-reviewed journals, conference proceedings, or academic book chapters, (3) were written in English or Arabic, (4) were published between 2015 and 2025, and (5) provided empirical findings, theoretical discussions, or technological developments relevant to Arabic language education.

Conversely, studies were excluded if they: (1) focused exclusively on Arabic natural language processing without educational implications, (2) consisted of editorials, opinion papers, dissertations, or unpublished manuscripts, (3) lacked sufficient methodological information, or (4) represented duplicate records identified across

multiple databases.

Study Selection Process

The study selection process consisted of four stages: identification, screening, eligibility assessment, and inclusion. Initially, database searches yielded 742 records. After removing 118 duplicate records, a total of 624 studies remained for title and abstract screening. During the screening stage, 471 studies were excluded because they did not meet the inclusion criteria. Subsequently, 153 full-text articles were assessed for eligibility. Following detailed evaluation, 97 articles were excluded due to insufficient relevance, methodological limitations, or lack of educational focus. Ultimately, 56 studies were retained and included in the final review.

Data Extraction Procedure

A structured data extraction protocol was developed to ensure consistency in data collection. Information extracted from each study included publication year, country of origin, educational setting, participant characteristics, AI technology utilized, research methodology, language skills addressed, key findings, reported benefits, identified challenges, and recommendations for future research. The extracted data were systematically organized using spreadsheet software to facilitate comparison and thematic categorization across studies.

Data Analysis

The collected data were analyzed using thematic analysis. This analytical approach enabled the identification of recurring patterns, emerging themes, and significant trends within the literature. The analysis process involved multiple stages, including familiarization with the data, initial coding, theme generation, theme refinement, and interpretation. Through this process, several major themes emerged, including AI technologies used in Arabic language learning, educational benefits, pedagogical implications, implementation challenges, and future research opportunities. The thematic synthesis allowed the review to generate a comprehensive understanding of how AI has transformed Arabic language education and to identify directions for future scholarly inquiry.

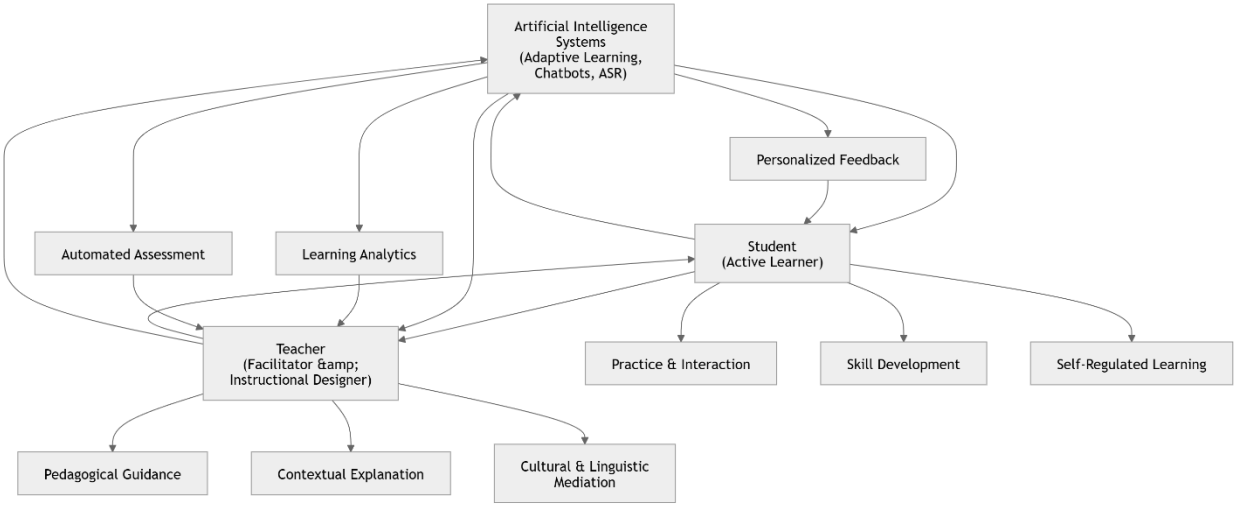
Validity and Reliability

To enhance the credibility of the review, the study followed established SLR procedures and maintained transparent documentation throughout each stage of the review process. The use of multiple databases reduced publication bias, while predefined inclusion and

exclusion criteria increased selection consistency. Furthermore, systematic coding and thematic analysis ensured that findings were derived from evidence-based interpretation rather than subjective judgment. These measures contributed to the overall validity, reliability, and replicability of the review.

RESULT

The thematic analysis of the collected literature reveals that contemporary AI integration in Arabic language education is predominantly characterized by the implementation of adaptive learning platforms, chatbot-based conversational practice, and automated speech recognition systems (Fitri, 2025).



These technologies function as catalysts for personalized instruction, enabling learners to engage with tailored exercises that accommodate individual proficiency levels and linguistic needs (Asfar et al., 2024). Such intelligent tutoring systems demonstrate a capacity to update learner models dynamically, allowing for an instructional process that adjusts in real time to specific student requirements (Mohideen, 2024).

Furthermore, these platforms enhance pedagogical efficacy by providing immediate, automated feedback on writing and speaking tasks, which significantly supports students in refining their linguistic precision (Azwir et al., 2024). Beyond these functional benefits, empirical evidence indicates that integrating these tools can drive substantial improvements in learner engagement and long-term retention rates (Nugraha & Syafe'i, 2025).

Nonetheless, these advancements require a balanced pedagogical approach, as research suggests that AI should be implemented as a supplement to, rather than a replacement for, formal classroom instruction (Yang & Kyun, 2022). Additionally, the integration of inclusive design principles remains a critical imperative to ensure that

these digital tools are accessible to all learners, including those with diverse physical and sensory requirements (Fibriasari et al., 2025).

However, the reliance on these automated systems must be tempered by a recognition of the inherent "empathy gap" in current AI models, which often fail to replicate the nuanced, culturally situated guidance provided by human instructors (Acar et al., 2025). Consequently, future research must shift its focus toward hybrid models that integrate these technological capabilities with pedagogical strategies that preserve the essential socio-cultural and emotional dimensions of language learning (Kartal & Yeşilyurt, 2024).

Moreover, the transition toward student-centered methodologies necessitates a corresponding shift in teacher roles, requiring educators to develop the digital literacy required to curate and manage these AI-driven environments effectively (Sumiarni et al., 2026). This pedagogical transition acknowledges that while Intelligent Tutoring Systems and chatbots provide immersive practice environments, they lack the capacity to interpret complex situational contexts inherent in Arabic linguistic nuances (Praveena & Anupama, 2025). Therefore, optimizing these systems requires a collaborative framework that bridges technical infrastructure with culturally responsive pedagogical design (Alhamam, 2025).

Moving forward, future developments must prioritize the creation of dialect-aware conversational agents capable of managing the diglossic nature of Arabic to ensure that learners receive contextually accurate feedback (Gutiérrez, 2023, p. 189; Sun & Wu, 2026). Such advancements necessitate the formation of multidisciplinary teams comprised of educators, technologists, and linguists to develop standardized best practices that account for the unique pedagogical requirements of the Arabic language (Alharthi, 2024, p. 30).

Furthermore, establishing these standards requires a commitment to transparency regarding data governance and algorithmic bias to foster inclusive environments that honor regional linguistic diversity (Fountoulakis, 2024). Moreover, longitudinal inquiries are essential to assess the long-term impact of these systems on Arabic language acquisition, particularly concerning how learners navigate evolving interrelationships between technical chatbot design and their own developing proficiency (Wiboolyasarin et al., 2024).

Future investigations should also prioritize the integration of predictive learning

analytics to capture nuanced engagement patterns, thereby moving beyond simple output assessment toward a more holistic understanding of the Arabic learning journey (Zhou et al., 2025). Additionally, research should investigate how these tools influence teacher identity and instructional decision-making within the specific sociocultural complexities of the Arab world (Karakaya et al., 2025).

Finally, research into comprehensive instructional design principles must expand to evaluate the success of these features in fostering student achievement across both online and hybrid learning environments (Hess, 2021). Beyond technical implementation, future research must incorporate user experience perspectives, derived from human–computer interaction paradigms, to ensure that voice interfaces accommodate the unique interaction patterns of non-native speakers rather than merely replicating native-speaker norms (Xiao et al., 2023).

Furthermore, the development of sophisticated error correction and personalized feedback algorithms remains a priority to enhance the authenticity of learner interactions with these systems (Koç & Savaş, 2024). Specifically, bridging the gap between large language models and semantic technologies through ontology-based classification may better enable systems to decode complex idiomatic expressions and the multifaceted nuances inherent in diverse Arabic dialects.

Furthermore, adopting transfer learning and data augmentation techniques from low-resource language processing can significantly improve the accuracy of these systems in managing the complexities of specialized Arabic domains (Essam et al., 2024). In this pursuit, researchers must prioritize the establishment of robust governance frameworks and transparent data policies to mitigate risks related to algorithmic bias and privacy (Rusmiyanto et al., 2023), (Ye et al., 2025).

Addressing these challenges is essential to building user trust and ensuring that AI integration aligns with ethical standards for pedagogical data (Alshahrani, 2023). Furthermore, educational institutions must invest in the requisite technological infrastructure to lower the barriers to entry for teachers, ensuring that implementation does not become an undue burden on instructional time (Han & Lee, 2024).

Ultimately, bridging these digital divides requires mapping discrepancies in hardware and bandwidth availability across diverse regional educational settings to ensure equitable access to AI-enhanced curricula (Xu & Ping, 2025). Indeed, such systemic efforts are fundamental to promoting educational equity, as they facilitate

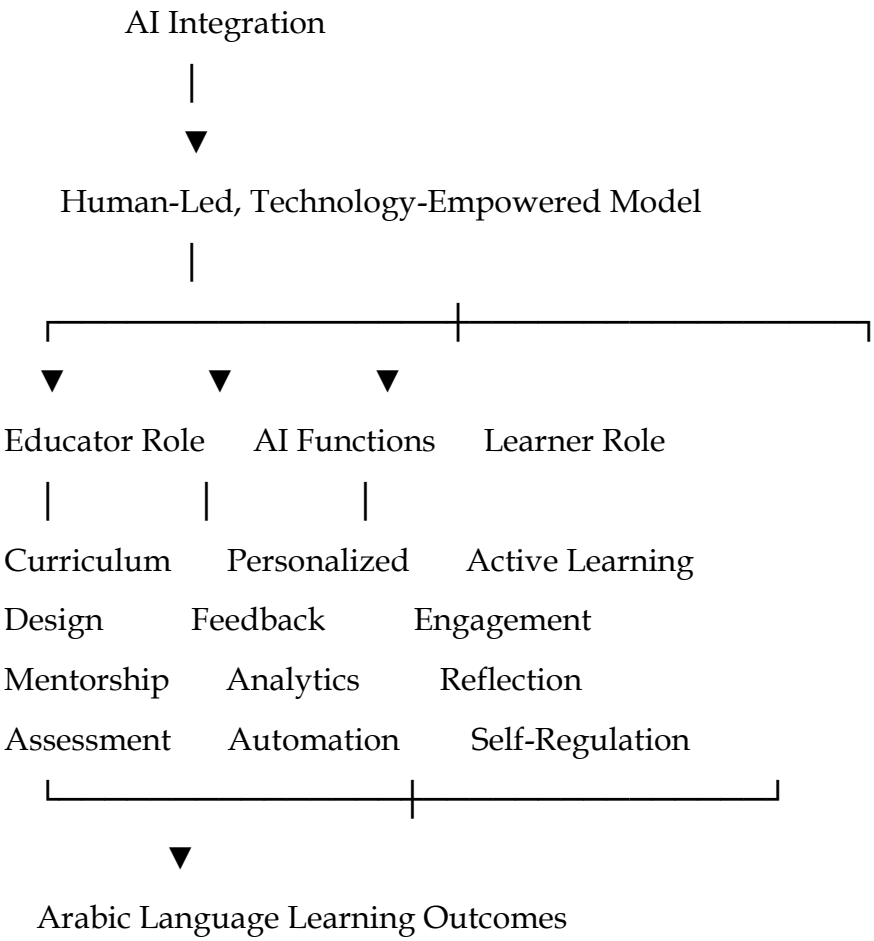
personalized learning pathways while simultaneously addressing the socioeconomic disparities that currently constrain student engagement with advanced digital tools (Acar et al., 2025).

By aligning these technological advancements with proactive pedagogical policies and inclusive design, institutions can effectively transform AI from a potential source of digital exclusion into a powerful instrument for academic empowerment, thereby ensuring that the benefits of language innovation are distributed fairly across all student populations, regardless of their background or regional context (Fibriasari et al., 2025).

DISCUSSION

The findings of this review underscore a critical tension between the rapid technological proliferation of AI-driven language tools and the pedagogical maturity required for their effective classroom integration. While these systems offer unprecedented opportunities for personalized feedback and immersive practice, their implementation often outpaces the development of localized curricula and the necessary professional training for educators to manage these complex environments (Acar et al., 2025).

Bridging this divide requires moving beyond superficial adoption toward a more intentional approach that embeds AI within a robust, culturally responsive pedagogical framework, ensuring that technical capabilities support rather than supersede the essential socio-cultural and communicative dimensions of Arabic language acquisition (Alhamam, 2025). Additionally, realizing this potential necessitates a balanced synergy where human instructors curate content and mentor students, while AI manages administrative tasks and provides real-time personalized practice (Amin, 2023).



This collaborative model effectively addresses existing gaps in digital literacy and infrastructure by ensuring that technology serves as a scaffolded resource rather than a replacement for expert instruction (Eden et al., 2024). By adopting such human-in-the-loop strategies, stakeholders can actively counter algorithmic biases that might otherwise alienate learners from diverse dialectal backgrounds (Tiwari, 2024).

Furthermore, prioritizing the inclusion of diverse linguistic and cultural datasets during model training is imperative to mitigate systemic biases and improve the contextual accuracy of AI-generated content (Fredrick & Craven, 2025). Moreover, establishing consistent collaborative channels between developers, educators, and researchers is vital to ensure that these evolving tools remain both pedagogically sound and sensitive to the specific sociocultural nuances of Arabic-speaking regions (Xia et al., 2024).

Such collaborative frameworks must also emphasize the development of adaptive systems capable of aligning with individual learner needs (Acar et al., 2025), while simultaneously fostering the metacognitive skills required to navigate these digital environments effectively (Alhamam, 2025).

By integrating predictive learning analytics, these tools can move beyond static

feedback to provide personalized pathways that encourage students to reflect on their own learning processes and strategies (Xiao et al., 2023). This evolution towards intelligent scaffolding ensures that AI technology does not merely serve as a passive delivery mechanism but as an active partner in helping learners cultivate the self-regulation necessary for successful autonomous language acquisition in a complex digital landscape (Acar et al., 2025). Moreover, adopting a "human-led, technology-empowered" framework ensures that pedagogical values retain primacy, thereby preventing the reduction of Arabic language instruction to mere algorithmic efficiency or commercial standardization (Acar et al., 2025).

By centering the educator's role in curriculum design and student mentorship, institutions can ensure that AI-driven tools reinforce, rather than replace, the essential sociocultural and cognitive dimensions of language acquisition (Karakaya et al., 2025); (Xiao et al., 2023). Integrating such governance mechanisms helps to safeguard the cultural integrity of language learning while fostering critical thinking and empathy as core academic competencies (Hasanah & Rufaiqoh, 2025). Ultimately, this necessitates the institutionalization of AI literacy among all stakeholders, fostering a shared understanding of algorithmic interpretability and the ethical application of diagnostic tools to support diverse educational needs (Ifenthaler et al., 2024).

Furthermore, developers must prioritize transparency in algorithmic decision-making to provide educators and students with deeper insights into how language models generate specific outputs (Betal, 2023). This transparency is essential, as it establishes a robust mechanism for human oversight, ensuring that teachers retain their role as the ultimate arbiters of educational quality and are capable of verifying the accuracy of AI-generated linguistic content (Amin, 2023). By systematically empowering educators to critically assess and refine algorithmic outputs, institutions can effectively position AI as a scaffolded pedagogical resource rather than an opaque, autonomous authority.

Such a proactive stance not only preserves the pedagogical integrity of Arabic language instruction against potential content distortions but also fosters learners' own critical metacognitive faculties, enabling them to engage with automated environments with greater discernment and analytical rigor (Alhamam, 2025).

Ultimately, this shift transforms the educator from a passive consumer of technology into an active designer and curator of personalized learning pathways,

ensuring that AI-enhanced integration remains aligned with broader socio-cultural goals and language acquisition objectives (Karakaya et al., 2025). Consequently, educational institutions must cultivate a collaborative mindset that views AI as a partner in the classroom, facilitating a shift where students and teachers alike maintain agency over the learning task (Gustilo et al., 2024).

CONCLUSION

Synthesizing this research confirms that the sustainable integration of AI into Arabic language education requires a holistic framework that harmonizes technological innovation with steadfast pedagogical intentionality and ethical oversight. By adopting comprehensive policies that promote transparency and professional development, institutions can establish a sustainable foundation that prioritizes both academic integrity and the enrichment of the learner experience. Future investigations must prioritize empirical studies that examine the longitudinal effects of these tools on students' long-term linguistic proficiency and academic success.

Such research is critical to move beyond short-term observations, ensuring that AI-enhanced methodologies produce durable cognitive and communicative advancements, particularly within the complex diglossic context of Arabic language acquisition. By rigorously tracking student development, these inquiries will offer the necessary evidence to refine pedagogical models, optimize the synergy between automated diagnostic feedback and human mentorship, and substantiate the sustainable educational value of these technological interventions. Furthermore, the development of robust, specialized Arabic-language datasets is essential to address the current data scarcity, ensuring that AI tools accurately reflect the diverse sociolinguistic realities inherent in formal and colloquial registers.

ACKNOWLEDGEMENT

The author declares no competing interests that could potentially influence the interpretation of these research findings. Moreover, future research must systematically investigate the longitudinal impact of these human-AI collaborations on student engagement and language proficiency, particularly in addressing the challenges of regional dialectal nuances and complex sociocultural contexts. Such empirical inquiries are critical to discerning how AI-driven feedback loops influence a learner's ability to navigate the intricate diglossic environment inherent in Arabic acquisition, ensuring that

technological interventions authentically support, rather than distort, both formal and colloquial linguistic registers. By rigorously mapping these long-term developmental outcomes, scholars can identify optimal pedagogical configurations that maximize communicative precision while simultaneously safeguarding the distinct linguistic and cultural identities essential to the Arabic learning experience.

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