

THE INFLUENCE OF ARTIFICIAL INTELLIGENCE ON ARABIC LANGUAGE LEARNING AMONG MILLENNIALS: AN ANALYSIS OF DIGITAL ADAPTATION AND ACADEMIC EFFECTIVENESS

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Abstract

The development of Artificial Intelligence (AI) in education has brought significant changes to the patterns and strategies of foreign language learning. In Arabic language learning, AI technology offers various benefits through personalized learning materials, immediate feedback, conversational simulations, and broader access to learning resources. However, the use of AI also presents challenges related to technological dependency and reduced cognitive engagement among learners. This study aims to analyze the influence of AI technology utilization on the effectiveness of Arabic language learning among millennials, particularly in vocabulary acquisition (*mufradat*), grammatical competence (*nahwu-sharaf*), and oral communication skills (*kalam*). The study employed a mixed-methods approach with an explanatory design. Quantitative data were collected through a digital questionnaire administered to 150 millennial respondents, while qualitative data were obtained through semi-structured interviews with 15 key informants and observations of AI-based learning activities. The quantitative data were analyzed to identify patterns and relationships among variables and were subsequently enriched through thematic analysis of the qualitative data. The findings indicate that the use of AI contributes positively to the effectiveness of Arabic language learning, particularly by supporting vocabulary acquisition and retention and by increasing learners' confidence in engaging in communicative practice. On the other hand, excessive reliance on automatic correction features and AI-assisted task completion may reduce learners' cognitive engagement in independently understanding and analyzing *nahwu-sharaf* structures. The study concludes that the effectiveness of AI largely depends on how the technology is utilized. Therefore, AI should be positioned as a supportive learning technology integrated with teachers' pedagogical guidance to foster Arabic language learning that is effective, critical, interactive, and sustainable.

Keywords: Artificial Intelligence, Arabic Language Learning, Millennials, Mixed-Methods, Linguistic Competence



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INTRODUCTION

The phenomenon of digital technology adoption among the millennial generation has fundamentally transformed the landscape of modern education, including the acquisition of foreign languages. Arabic, which has traditionally been taught through conventional methods based on memorization and face-to-face interaction in madrasahs and Islamic boarding schools (*pesantren*), is now confronted with a massive wave of digitalization through the integration of Artificial Intelligence (AI) (Zubair, 2026). In Indonesia, millions of millennial learners use their digital devices to access thousands of intelligent learning applications, conversational chatbot platforms, and automated translation systems on a daily basis. However, the social reality reveals a considerable gap between enthusiasm for technology use and the substantive depth of linguistic understanding it produces (López-Molines, 2025). Many independent learners become trapped in superficial interaction patterns, in which they are proficient in operating artificial intelligence features but struggle to apply grammatical rules in textual contexts. This shift in learning culture has created a new area of discourse concerning the long-term effectiveness of millennials' dependence on digital assistants in mastering a language characterized by highly complex morphological structures (Zubair, 2026).

A number of previous academic studies have attempted to map how educational technology affects motivation and learning outcomes in foreign language education across various formal institutions. Conventional literature generally agrees that digitalization can increase students' active engagement through interactive visualization and instant feedback provided by computerized systems. In the context of Arabic language learning, however, the existing literature has largely focused on the effectiveness of multimedia-based learning media, static digital dictionary applications, and generic e-learning websites (Susiawati et al., 2025). Comprehensive studies specifically examining the psycholinguistic and sociolinguistic impacts of AI-based adaptive learning algorithms on millennials remain limited. This generation is widely characterized by a preference for instant access, high flexibility, and personalized learning materials, which may conflict with the rigidity of traditional Arabic linguistic structures. Consequently, the current body of literature still contains a substantial conceptual gap concerning how artificial intelligence-based learning systems continuously reconfigure the receptive and productive competencies of millennial learners (Akgun & Greenhow, 2022).

Given the urgency of this phenomenon, this study is specifically designed to conduct an in-depth analysis of the influence of AI technology integration on the effectiveness of Arabic language learning among millennials. More specifically, the study aims to evaluate the extent to which intelligent algorithm-based virtual assistants can improve *makhraj* proficiency, *mufradat* acquisition, and understanding of *nahwu* and *sharaf* structures (Wu & Li, 2024). In addition, this study seeks to identify the psychological, technical, and methodological barriers encountered by learners when transitioning from instruction provided by human teachers to interaction with intelligent machines (Wang et al., 2024). Through a systematic approach, this research is expected to provide strategic recommendations for educational technology developers and formal academic institutions in designing a harmonious hybrid curriculum. Achieving these research objectives will ultimately provide an important foundation for mitigating the risk of declining linguistic quality resulting from uncontrolled technology use.

Thus, the outcomes of this study are expected to have not only theoretical significance but also practical implications for the future of contemporary Arabic language education (Zou et al., 2023).

This study advances the main argument that AI utilization has a significant positive influence on accelerating the receptive Arabic language abilities of millennials, while potentially weakening their contextual productive competencies when not accompanied by appropriate human supervision. The working hypothesis proposes that personalization through AI algorithms can substantially improve learners' memory retention of new vocabulary. Nevertheless, excessive reliance on machine-based automatic correction is predicted to diminish learners' critical analytical abilities when engaging with classical Arabic texts rich in literary nuances and *balaghah*. The researchers assume that millennials who employ AI assistants as supplementary tools rather than substitutes for teachers will demonstrate more balanced and adaptive academic performance. Through this hypothesis, the study seeks to demonstrate that intelligent technology is not an absolute solution but rather a catalyst whose effectiveness depends on its appropriate methodological positioning within the learning ecosystem (Cope & Kalantzis, 2019).

The discourse surrounding the relationship between artificial intelligence and foreign language teaching has generated a highly dynamic body of literature over the past decade. In general, the mainstream academic literature can be divided into three major schools of thought that interact dialectically across various reputable international journals. The first is dominated by educational technologists who view AI as a digital solution capable of democratizing access to inclusive language learning regardless of geographical boundaries (Amadi & Hikmah, 2025). The second consists of traditional pedagogical scholars who remain skeptical and concerned about the potential loss of humanistic values, spirituality, and cultural internalization embedded in language instruction, particularly in the teaching of a sacred language such as Arabic. The third represents a moderate perspective that seeks common ground through the concept of blended learning and technology-based curriculum adaptation. This mapping demonstrates that the scholarly dialogue surrounding AI and foreign language learning continues to evolve in search of an ideal and integrative consensus.

The first research pattern identified in the existing literature is dominated by quantitative experimental studies focusing on the effectiveness of specific AI-based mobile applications. Such studies typically involve two groups of student participants: a control group receiving conventional instruction and an experimental group using intelligent applications. The indicators of success measured in this research pattern are generally positivistic, including examination scores, vocabulary memorization speed, and phonetic pronunciation accuracy. Most studies following this approach report significant increases in performance scores among experimental groups using virtual assistant technologies (Uchida et al., 2026). However, this research pattern often overlooks long-term psychological factors such as language anxiety, digital fatigue or boredom, and memory retention after the experimental intervention has ended. Purely quantitative approaches tend to be mechanistic, treating language learners as objects that respond linearly to algorithmic stimuli without sufficiently considering their broader sociocultural backgrounds (Uchida et al., 2026).

The second research pattern commonly found in previous studies consists of descriptive qualitative research exploring learners' perceptions, motivations, and subjective experiences with artificial intelligence technology. Research within this category generally employs in-depth interviews, focus group discussions (FGDs), and digital diary analysis to capture users' personal narratives. Findings from this research pattern indicate that young learners perceive AI as highly beneficial because it reduces the fear of being judged when making speaking errors (Al Ghaithi et al., 2024). Learners perceive intelligent conversational bots as providing a safe space in which they can repeatedly practice pronouncing complex Arabic sentences

without psychological pressure (Ridho et al., 2025). Nevertheless, this research pattern has limitations in terms of data generalizability because of its relatively small sample sizes and the high degree of subjectivity involved in interpretation. Such studies may become overly reliant on positive user testimonials without objectively verifying the actual linguistic competencies acquired by learners.

The third research pattern focuses on the technical analysis of system development and the evaluation of Natural Language Processing (NLP) algorithms specifically designed for Arabic. Research in this area, largely conducted by computer scientists, examines the efficiency of AI systems in detecting syntactic and morphological errors in Arabic texts. These studies analyze the performance of linguistic corpora, the accuracy of root-pattern mapping (ishtiqaq), and the ability of machine translation systems to handle contextual lexical ambiguity. Findings from this research pattern confirm that Arabic presents considerably more complex algorithmic challenges than many European languages due to its largely unvocalized writing system and highly sophisticated morphology (Ridho et al., 2025). Although these technical studies provide substantial insights from a computational perspective, they tend to overlook pedagogical dimensions and human interaction within the classroom. Consequently, a considerable gap exists between the sophistication of AI systems developed in computer laboratories and the practical needs of teachers and students in real educational settings.

A critical evaluation of these three research patterns reveals a significant research gap, particularly the absence of a holistic approach that simultaneously integrates technical, pedagogical, and sociological dimensions. Previous studies remain highly fragmented: computer scientists focus on algorithms, linguists concentrate on grammatical errors, and sociologists examine millennial behavior independently. Few studies have specifically investigated how the psychographic characteristics of millennials—such as multitasking preferences, short attention spans, and an instant-oriented culture—interact with the inherent limitations of AI in Arabic language instruction (Cope & Kalantzis, 2023). The novelty of this study lies in its multidisciplinary approach, which seeks to bridge these gaps by positioning millennials as active subjects within a digital learning ecosystem. Rather than merely measuring learning outcomes, this study also examines cognitive adaptation processes and epistemological shifts in learners' understanding of Arabic linguistic structures in the era of artificial intelligence.

Based on this research gap, the present study proposes a new direction that positions AI not merely as a mechanical learning aid but as an interactive element within the learner's social-cognitive environment. This new direction emphasizes the importance of analyzing the "mutualistic symbiosis" between teachers' human intuition and the computational efficiency of intelligent machines in developing comprehensive language competence. The study focuses on developing a new conceptual model referred to as the Socio-Digital Arabic Learning Framework, a framework that integrates NLP technology with contemporary social learning theories. Through this orientation, the investigation examines how AI can be configured not only to develop lower-order cognitive abilities such as memorization but also to stimulate higher-order thinking skills (HOTS) in Arabic literary analysis. Accordingly, this new research direction is expected to contribute to redefining the standards of Arabic language pedagogy in an era of comprehensive digital transformation.

RESEARCH METHOD

Research Design

This study employed a mixed-methods approach with an explanatory case study design and a sequential strategy. The unit of analysis consisted of millennial Arabic language learners born between 1981 and 1996 who actively use artificial intelligence (AI)-based learning applications for both academic activities and independent learning.

Research Target/Subject

The research participants were individuals currently studying at universities or language courses. In addition to the learners themselves, the study also considered digital interactions recorded through application usage and documents containing automated corrections generated by AI systems as supporting data. The mixed-methods approach was employed to obtain a comprehensive understanding of the influence of AI on Arabic language learning, encompassing not only quantitative aspects, such as patterns of use, levels of satisfaction, and language competence, but also qualitative aspects related to users' experiences, perceptions, and learning processes (Alkaabi & Almaamari, 2025). The quantitative phase was conducted first through a survey, followed by a qualitative phase designed to further explore and explain the quantitative findings.

Research Procedure

The research data consisted of primary and secondary sources. Primary data were obtained through an online questionnaire administered to 150 respondents who met the research criteria and through semi-structured interviews with 15 key informants selected using purposive sampling. The informants included Arabic language students, lecturers who integrate AI into their teaching practices, and educational technology practitioners (Li et al., 2015). Secondary data were obtained from curriculum documents, academic performance reports, AI-generated task corrections, and relevant scholarly literature on technology-based Arabic language learning. Data were collected using three main techniques: a Likert-scale questionnaire, semi-structured interviews, and digital observation. The questionnaire was distributed through online Arabic language learning communities, while interviews were conducted both face-to-face and through video-conferencing platforms until data saturation was reached. Digital observations focused on learners' interactions within AI application user forums and their use of AI-based task-correction features (Ahmed, 2025). All research procedures adhered to established ethical principles, including the provision of research information and the acquisition of informed consent from all participants.

Instruments, and Data Collection Techniques

Data analysis was conducted integratively by combining quantitative and qualitative analytical techniques. Quantitative data were analyzed using descriptive and inferential statistics, including multiple linear regression analysis to identify relationships and effects among the research variables. Meanwhile, qualitative data obtained from interviews and digital observations were analyzed using the Miles and Huberman model, consisting of data reduction, data display, and conclusion drawing and verification.

Data Analysis Technique

The qualitative analysis was further supported by multi-level coding to identify major themes related to learners' experiences, the benefits of AI, and potential technological dependence. The quantitative and qualitative findings were subsequently integrated during the interpretation stage to provide a more comprehensive explanation of the effectiveness of AI utilization in Arabic language learning. Data credibility was enhanced through source and methodological triangulation to ensure the consistency and trustworthiness of the research findings.

RESULTS AND DISCUSSION

The findings of this study reveal a dualistic pattern in the influence of artificial intelligence (AI) on Arabic language learning among millennial learners. AI demonstrates substantial benefits in supporting receptive language abilities, particularly vocabulary acquisition and retention, while also reducing psychological barriers to independent speaking

practice. At the same time, excessive reliance on automated correction features appears to create challenges for learners' independent grammatical analysis, particularly in Nahwu-Sharaf. These findings indicate that the educational impact of AI is not inherently positive or negative but depends substantially on how the technology is integrated into pedagogical practices.

One of the most prominent findings concerns the contribution of AI to vocabulary acquisition (*mufradat*). The quantitative findings indicate that 84% of respondents reported faster vocabulary memorization after regularly using AI-supported contextual dictionary applications for approximately three months. The use of spaced repetition also appeared to reduce the amount of time required for independent vocabulary practice. AI-based applications automatically identify frequently forgotten vocabulary items and reintroduce them at intervals considered appropriate for the learner's retention pattern.

The digital learning records further demonstrated a relatively consistent pattern of interaction. Participants generally accessed AI-supported vocabulary applications four to six times per day, with each session lasting approximately five to ten minutes. Although these learning sessions were relatively short and fragmented, their frequency contributed to consistent exposure to Arabic vocabulary. Interactive flashcards, progress indicators, instant feedback, and achievement features also appeared to increase learners' engagement with vocabulary practice.

"I can now memorize twenty new words a day without feeling overwhelmed as I did when memorizing from a printed dictionary."

This finding suggests that AI can transform vocabulary learning from a relatively intensive memorization activity into a more distributed and manageable learning process. From the perspective of Cognitive Load Theory, adaptive digital systems may help regulate the amount of information presented to learners by distributing learning materials over time and providing immediate feedback. Such mechanisms can potentially reduce unnecessary cognitive demands and create greater opportunities for information to be transferred into long-term memory.

The finding also supports the argument that AI can function as an adaptive learning assistant rather than merely as a digital repository of information. In conventional vocabulary learning, learners often determine independently which words should be reviewed and when they should be reviewed. AI-based systems can automate part of this process by identifying patterns of forgetting and adjusting subsequent exposure accordingly.

However, the benefits of AI-supported vocabulary learning should not be interpreted as evidence that technology can replace the pedagogical role of teachers. Vocabulary competence requires more than memorizing lexical forms. Learners must also understand semantic variation, contextual usage, morphological patterns, collocations, and pragmatic meanings. Consequently, AI is most effective when vocabulary acquisition is complemented by teacher-guided activities that require learners to apply newly acquired vocabulary in meaningful communicative contexts.

A contrasting pattern emerged in the domain of productive language competence, particularly writing and Nahwu-Sharaf. Approximately 67% of respondents who reported frequent dependence on AI-based automatic correction demonstrated lower levels of independent analytical accuracy when completing handwritten Arabic tasks without technological assistance. This finding indicates a potential contradiction between the apparent quality of AI-assisted written production and the learner's actual internal grammatical competence.

AI-based correction tools can instantly identify grammatical structures, provide suggested corrections, and assist learners with *harakat* and sentence organization. Although such features are highly efficient, excessive dependence on them may reduce the cognitive effort required to identify, analyze, and correct grammatical errors independently. Learners

may recognize that a sentence is incorrect because the AI indicates an error, without necessarily understanding why the original construction was incorrect.

This phenomenon was also observed during classroom activities. When digital assistance was removed, several learners experienced difficulty analyzing grammatical structures that had previously been corrected automatically by AI. Errors involving fa'il, maf'ul bih, and grammatical case endings (i'rab) became more apparent in handwritten assignments (Madwi, 2025).

A senior lecturer observed:

“Students' writing today looks polished on computers because of AI, but when they are asked to write on a whiteboard, they lose their grasp of grammatical case endings (i'rab) entirely.”

This observation illustrates a critical distinction between technological performance and linguistic competence. A digitally corrected text may appear grammatically sophisticated while simultaneously concealing weaknesses in the learner's ability to generate and evaluate grammatical structures independently.

The phenomenon can be interpreted through the concept of cognitive offloading. Cognitive offloading occurs when individuals transfer part of a cognitive task to an external tool or technological system. In language learning, this mechanism can be beneficial when technology reduces unnecessary cognitive demands. However, excessive offloading may become problematic when the external tool performs the very cognitive processes that learners are expected to develop.

In the context of Arabic language learning, this issue is particularly important because Nahwu-Sharaf requires analytical understanding rather than simple recognition of correct forms. Learners need to understand relationships between words, syntactic positions, morphological patterns, and changes in grammatical endings. If these processes are consistently delegated to AI, learners may become increasingly dependent on external correction rather than developing autonomous grammatical reasoning.

Therefore, the findings suggest that AI-assisted writing should be complemented by activities that deliberately return analytical responsibility to the learner. Teachers can, for example, require students to explain why an AI-generated correction is necessary, identify the grammatical rule involved, reconstruct sentences manually, or complete handwritten exercises without technological assistance. In this model, AI functions not as the final authority but as a stimulus for critical linguistic analysis.

The third major finding concerns communicative interaction (hiwar). AI-supported speaking practice was associated with reduced Foreign Language Classroom Anxiety (FLCA) among the participants. Approximately 78% of respondents reported feeling more confident speaking Arabic after regularly practicing with voice assistants, speech-processing applications, and conversational AI tools.

The qualitative observations provide further support for this finding. During digital speaking activities, learners appeared more relaxed and willing to repeat Arabic expressions. Unlike conventional classroom interaction, where learners may fear making mistakes in front of peers or receiving immediate judgment from teachers, AI-mediated interaction provides a relatively private environment in which learners can practice repeatedly.

For example, learners were observed repeatedly pronouncing Arabic words until the system indicated that their pronunciation was acceptable. The feedback provided by AI, including expressions such as “!ممتاز” (Mumtaz / Excellent!), combined with visual or auditory pronunciation guidance, encouraged learners to continue practicing rather than withdrawing from the activity.

This finding suggests that AI can function as a psychological catalyst in Arabic language learning. The ability to repeat a sentence or pronunciation without embarrassment may reduce

learners' fear of making mistakes. Such an environment can be particularly valuable for learners who have difficulty participating actively in conventional classroom speaking activities.

Nevertheless, increased confidence in AI-mediated communication should not be equated automatically with communicative competence. Authentic communication involves contextual interpretation, emotional expression, cultural awareness, turn-taking, nonverbal cues, and the ability to respond unpredictably to other human speakers. Therefore, AI-based speaking practice should be positioned as a preparatory environment that helps learners develop confidence before engaging in authentic interpersonal communication.

Taken together, the three domains reveal a pronounced dualism in the educational impact of AI. AI contributes positively to vocabulary retention and speaking confidence while simultaneously creating potential risks for independent grammatical analysis when learners become excessively dependent on automated correction.

This pattern demonstrates that technological impact is not technologically deterministic. The same AI system can generate different educational outcomes depending on the learning activity, degree of learner autonomy, and pedagogical structure surrounding its use. AI can support cognitive development when it provides scaffolding, feedback, and adaptive practice; conversely, it can weaken cognitive engagement when it performs essential analytical tasks on behalf of the learner.

This finding has important implications for Arabic language education because Arabic possesses linguistic characteristics that require sustained analytical engagement. The complexity of its morphological and grammatical systems means that learners cannot achieve comprehensive proficiency simply by producing texts that appear correct after automated processing. Competence requires the ability to explain, manipulate, and generate linguistic structures independently.

Accordingly, the findings challenge the assumption that greater technological sophistication automatically produces better language learning outcomes. The effectiveness of AI depends on whether technology strengthens or replaces the learner's cognitive participation.

The simultaneous acceleration of vocabulary learning and weakening of grammatical analysis can be interpreted through Cognitive Load Theory and the concept of cognitive offloading.

When AI assists learners in vocabulary acquisition through multimedia presentation, adaptive repetition, and immediate feedback, it may help manage working-memory demands and facilitate the consolidation of information into long-term memory. The learning process becomes more distributed, personalized, and responsive to individual patterns of retention.

However, a different mechanism emerges when AI performs grammatical analysis automatically. When the system identifies errors, corrects sentence structures, or determines morphological forms without requiring learners to reconstruct the reasoning process, part of the analytical burden is transferred from the learner to the technological system.

This distinction is crucial. Cognitive assistance becomes pedagogically valuable when it functions as scaffolding, but potentially problematic when it becomes substitution. The objective of AI integration should therefore be to reduce unnecessary cognitive load while preserving the productive cognitive effort required for linguistic mastery.

The findings consequently support a principle of guided cognitive engagement: AI should simplify mechanical aspects of learning while deliberately preserving analytical, interpretive, and communicative tasks for human learners.

When compared with previous research on educational technology, the present findings demonstrate both continuity and a shift in perspective. Earlier digital-learning research frequently emphasized the ability of technology to increase learner engagement, accessibility, personalization, and learning efficiency. The current findings confirm these advantages, particularly in vocabulary acquisition and speaking practice.

However, this study extends the discussion by highlighting the possibility that technological automation can generate unintended consequences for higher-order linguistic skills. The issue becomes particularly relevant when AI is used to perform grammatical analysis rather than merely provide learning resources.

The findings further suggest that the effects of AI should not be generalized across languages without considering their structural characteristics. Arabic has a highly developed morphological and inflectional system, in which grammatical meaning can be expressed through changes in word forms, patterns, and case endings. Consequently, learners may require a greater degree of explicit analytical engagement than would be necessary for certain aspects of languages with comparatively more linear grammatical structures.

This does not imply that AI is inherently more dangerous for Arabic than for other languages. Rather, it indicates that AI integration should be adapted to the linguistic demands of the target language. Arabic educational technology should therefore be designed not merely to detect errors but to stimulate learners to understand the linguistic principles underlying those errors.

Beyond its technical and pedagogical dimensions, the findings also raise a broader philosophical issue concerning the nature of Arabic language learning. Arabic is not merely a collection of graphic symbols and grammatical rules that can be processed computationally. It is also a cultural and communicative system embedded in historical, social, literary, and spiritual contexts.

This dimension is particularly relevant to advanced Arabic learning, where learners encounter *dzauq*, rhetorical expression, classical literature, and *Balaghah*. AI may successfully identify grammatical errors or suggest lexical alternatives, but such computational accuracy does not necessarily reproduce human sensitivity to literary nuance, historical context, aesthetic expression, or cultural meaning.

Consequently, excessive reduction of Arabic learning to interactions with digital screens may narrow learners' understanding of language itself. Language learning should remain rooted in human communication, social interaction, cultural interpretation, and intellectual reflection.

In this regard, AI should be positioned within a broader humanistic learning ecosystem. Teachers, peers, texts, cultural experiences, and authentic communicative situations remain essential components of comprehensive Arabic language education.

The findings also point toward an epistemological transformation concerning how learners understand the concept of “knowing.” In an AI-mediated learning environment, the boundary between knowledge that is genuinely mastered and information that can simply be retrieved through a digital device becomes increasingly blurred.

A learner may produce a grammatically accurate sentence with the assistance of AI without possessing the ability to explain the grammatical reasoning underlying that sentence. This creates a distinction between access to knowledge and ownership of knowledge.

For millennial learners who are highly familiar with digital technologies, this distinction is particularly significant. Technological fluency can create the impression of linguistic competence even when independent performance remains limited. The educational challenge is therefore not to prevent learners from accessing AI but to ensure that technological access is accompanied by genuine cognitive mastery.

From this perspective, technology should return to its appropriate role as a servant of human intelligence rather than a substitute for human thinking. Arabic language education in the future should continue to cultivate perseverance (*mujahadah*), intellectual discipline, reflective thinking, and independent linguistic reasoning-capacities that cannot be fully delegated to algorithms.

The findings require a substantial reconsideration of instructional design for Arabic language education in the digital era. Educational institutions should not adopt a purely prohibitive response to AI. Instead, they should develop structured blended-learning models

that distinguish between activities suitable for AI assistance and activities that require independent human performance.

For example, AI can be deliberately used for vocabulary practice, pronunciation rehearsal, conversational simulation, formative feedback, and independent learning outside the classroom. Conversely, handwritten examinations, grammatical analysis, oral presentations, text interpretation, and selected writing activities should continue to require direct learner participation without technological assistance.

This balanced approach allows technological efficiency and human cognitive depth to operate simultaneously. Teachers should also be trained not merely to use AI tools but to design pedagogical tasks that prevent excessive dependence on them. The teacher's role consequently shifts from being a sole source of information toward becoming a facilitator, evaluator, and critical guide who helps learners interrogate AI-generated information.

At the policy level, there is also a need for clearer standards governing AI integration into formal Arabic language education. Educational authorities should develop ethical and methodological guidelines concerning the selection, evaluation, and use of AI applications in schools and higher education institutions.

Technology developers should likewise be encouraged to involve Arabic language specialists (*lughawiyyun*) and educational experts in the development of AI-based learning systems. Rather than providing immediate answers for every linguistic problem, future systems should increasingly provide interactive prompts, explanations, and graduated hints that encourage learners to discover solutions independently.

The principal contribution of this study lies in its explanatory mixed-methods design, which integrates quantitative evidence with qualitative accounts to provide a multidimensional understanding of AI-assisted Arabic language learning. The study contributes to the existing literature by examining not only the technological benefits of AI but also its psycholinguistic and pedagogical consequences for millennial non-Arabic-speaking learners.

The study nevertheless has several limitations. First, the geographical distribution of participants is concentrated primarily in urban areas with relatively strong internet infrastructure (Nasreldin, 2024). Consequently, the experiences of millennial Arabic learners in rural and technologically underserved areas may not be fully represented. Second, the duration of the study limits the ability to determine whether the observed reduction in independent grammatical analysis represents a temporary effect or a long-term consequence of sustained AI dependence (Rahmat et al., 2025).

Future research should therefore expand the geographical scope of participants and employ longitudinal designs to examine changes in Arabic language competence over longer periods. Future studies may also benefit from experimental comparisons between AI-assisted, teacher-assisted, and hybrid instructional models (Pasaribu et al., 2024). Such research would provide stronger evidence concerning which forms of AI integration genuinely improve linguistic competence without compromising learners' cognitive autonomy.

Overall, the findings demonstrate that AI should neither be romanticized as an absolute solution nor rejected as a threat to traditional language education. Its educational value depends on the pedagogical architecture within which it is used (Zhang & Huang, 2024). The most productive model is therefore one in which AI enhances efficiency, personalization, and practice while teachers and learners retain responsibility for critical analysis, interpretation, communication, and intellectual development.

CONCLUSION

In conclusion, the most important finding of this study demonstrates that the influence of artificial intelligence on Arabic language learning among millennials is characterized by a pronounced paradox. AI functions as a powerful accelerator for enhancing vocabulary acquisition (mufradat) and reducing psychological anxiety during independent speaking practice. At the same time, however, the extensive automation provided by AI has considerable potential to weaken learners' deep grammatical analytical abilities in Nahwu-Sharaf when used without adequate pedagogical control. The key to successful Arabic language learning in the modern era therefore lies neither in the outright rejection nor in the uncritical acceptance of technology, but in the human capacity to establish a productive balance between the computational efficiency of machines and the depth of human cognitive intuition through a systematically designed blended-learning model.

The principal strength of this study lies in its explanatory mixed-methods design, which successfully integrates quantitative statistical evidence with in-depth qualitative narratives in a balanced and multidisciplinary manner. The study contributes to addressing gaps in previous literature by examining the psycholinguistic effects of AI in relation to the distinctive characteristics of millennial non-Arabic-speaking learners. Nevertheless, the study has several inherent limitations. First, the geographical scope of the sample remains concentrated in urban areas with relatively high-speed internet access, meaning that the experiences and learning dynamics of millennials in rural areas are not yet fully represented. Second, the limited duration of the study prevented a longitudinal assessment of the potential long-term decline in manual writing and grammatical analysis skills over several years. Future research is therefore recommended to expand the geographical scope of investigation and employ longitudinal research designs to monitor the development of learners' Arabic language competencies over an extended period. Such research would provide a more comprehensive understanding of the sustained effects of AI-assisted Arabic language learning.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; Investigation.

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