Navigating Student Autonomy: A Review of AI-Integrated Web-Based Strategies in Arabic Language Learning

Iswatun Hasanah[1*], Andre Saputra[2], Anwar Syafi'i[3], Fathul Maujud[4]

Abstract

This classroom action research aims to improve students' learning outcomes and engagement through an innovative learning evaluation based on Deep Learning using the QuizWhizzer digital platform in the Natural and Social Sciences (IPAS) subject. The initial problem identified was the low level of student participation in evaluation activities and the limited use of varied and engaging digital assessment media aligned with 21st-century learning demands. Integrating Deep Learning principles into the evaluation process was expected to help students develop deeper conceptual understanding, contextual reasoning, and reflective learning abilities. The study was conducted in two cycles following the Kemmis and McTaggart model, consisting of planning, action, observation, and reflection stages. The research subjects were 30 fifth-grade students. Data were collected through observations, interviews, documentation, and learning outcome tests, and analyzed using descriptive qualitative and quantitative approaches. The findings indicate a significant improvement in both student activity and learning outcomes. Mastery learning increased from 58% in the pre-cycle to 76% in Cycle I and reached 91% in Cycle II. Students also demonstrated higher motivation, stronger collaboration, and improved critical-thinking skills during the gamified evaluation process. The use of QuizWhizzer created an interactive, enjoyable, and competitive learning atmosphere that supported mindful, meaningful, and joyful learning. This study concludes that the Deep Learning–based evaluation using QuizWhizzer is an effective and innovative assessment strategy that enhances IPAS learning quality in elementary schools and can be recommended as an alternative digital evaluation method within the Merdeka Curriculum.

Keywords: deep learning; QuizWhizzer; learning evaluation; integrated natural and social sciences

Introduction

penetration has reached around 77% of the total population, indicating that society is increasingly reliant on digital technology to access information and learning resources (Social & Meltwater, 2023). In the context of Arabic language learning, the use of digital technology has moved beyond simple dictionary applications or basic e-learning platforms toward the integration of Artificial Intelligence (AI), web-based environments, and other technology-mediated media that can provide more interactive, personalized, and adaptive learning experiences. This transformation is particularly important because Arabic is linguistically complex at the levels of phonology, morphology, and syntax, and therefore requires more innovative instructional strategies. At the same time, Arabic language education still faces serious challenges, especially related to student motivation, limited teacher resources, and the lack of personalized learning approaches. A survey conducted by Supriadi et al (2020) found that more than 60% of Madrasah Aliyah students in Central Java reported difficulties in understanding Arabic grammar (*nahwu* and *sharaf*) despite having studied it for more than three years. In parallel, UNESCO (2021) reports that the use of intelligent technologies in education may

increase learning outcomes by up to 35% compared to conventional methods, suggesting an urgent need to explore how AI can be effectively utilized in Arabic language learning.

These developments are closely linked to the broader shift from the Industrial Revolution 4.0 to the Society 5.0 paradigm. Industrial Revolution 4.0 has introduced automation, big data, and AI as key drivers of efficiency and innovation, including in education (Ardhinar & Wibawa, 2022; Sabaruddin, 2022). Society 5.0, in turn, envisions a human-centered society where advanced technologies are harnessed sustainably to enhance quality of life and social well-being (Amalia & Munif, 2023; Lestari, 2025). In the educational sector, these shifts demand curriculum reform and the redesign of teaching methods so that students are equipped with the skills required to face technological and informational challenges (Masitoh & Purbowati, 2024; Sabaruddin, 2022). Consequently, teacher competence and adaptability to technology become crucial, as teachers are increasingly expected to use digital tools to facilitate more effective learning (Alfiyanto et al., 2024; Alvianto & Wibawa, 2022; Masitoh & Purbowati, 2024). At the same time, limited digital skills among both teachers and students, and unequal access to technology, remain structural obstacles that must be addressed through collaborative efforts among educational institutions, industry, and government 5(Amalia & Munif, 2023; Lestari, 2025).

Within this macro transformation, digital and web-based learning media have become central instruments in reshaping how teaching and learning occur. Digital learning media—such as gamified platforms, videos, and interactive applications—are widely reported to enhance student interaction, understanding, and enjoyment of learning (Afaria et al., 2022; Firdaus & Wijayanti, 2024; Luthfi et al., 2023). Meta-analytic evidence underscores the need for educational transformation at the secondary and vocational levels, where digital media can support competence-based curricula and improve teaching effectiveness (Bonok et al., 2024; Nasution et al., 2025). In higher education, the adoption of digital technologies has been shown to encourage greater learner autonomy and flexibility (Bonok et al., 2024). Web-based applications and digital platforms have also emerged as important innovations for language and culture education, including through web-based applications and digital comics designed to match the characteristics of digitally native students (Oktaviana & Ramadhani, 2023; Srihilmawati & Nurjanah, 2023). From a pedagogical perspective, these developments are most effective when grounded in frameworks such as Technological Pedagogical Content Knowledge (TPACK), which emphasizes the integration of technological, pedagogical, and content knowledge to create meaningful learning experiences (Agustina et al., 2025; Putri et al., 2023; Yanda et al., 2024). Nevertheless, studies indicate that many teachers and graduates still struggle to optimally utilize digital media due to limited training and access, thereby reinforcing the importance of digital literacy development among educators and students (Ni'am et al., 2024).

Despite these promising developments, Arabic language learning continues to encounter a range of persistent challenges related to motivation, vocabulary (*mufradāt*), grammar (*qawāʾid*), *muhādatsah*, and restricted face-to-face interaction. Motivation is particularly critical in technology-mediated learning environments. Research shows that active interaction in class, whether conducted face-to-face or via online platforms, can enhance student motivation and commitment to learning (Capinding, 2024; Telyani et al., 2021). Conversely, miscommunication, reduced social presence, and limited direct interaction often lead to declining motivation and engagement (Kopczynski & Silvia, 2024; Rakhshan et al., 2024). In vocabulary learning, students frequently struggle to recall and produce expressions, and are hindered by limited lexical resources (García & Vaca-Cárdenas, 2022; Rakhshan et al., 2024). Game-based strategies and playful activities have therefore been proposed and tested as effective solutions for enhancing vocabulary acquisition in Arabic (Ritonga et al., 2022). Grammar remains another major obstacle, with many students finding it difficult to understand

and apply grammatical rules, leading to anxiety and reluctance to participate in oral activities (Hastang & Ahmad, 2023). Interactive and contextualized learning methods—such as pair work, role-play, and everyday situational practice—have been shown to improve both grammar mastery and oral confidence (García & Vaca-Cárdenas, 2022; Minkhatunnakhriyah & Albiansyah, 2020).

The skill of *muhādatsah*, or Arabic conversation, is particularly vulnerable to disruption, especially when face-to-face interaction is reduced. Studies during and after the COVID-19 pandemic highlight how restrictions on physical meetings have diminished opportunities for authentic communication and weakened the social dimension of language learning (Kopczynski & Silvia, 2024; Pather et al., 2020; Rakhshan et al., 2024). Gaps in communication, low motivation, and infrequent learning sessions are often cited as factors that impede student progress in speaking (Hastang & Ahmad, 2023; Saragih & Listyani, 2021). To address these problems, scholars recommend blended approaches that combine online and offline modes with active, participatory teaching methods (Awabdeh & Albashtawi, 2023; Syaikhudin & Laili, 2024). These conditions suggest that a comprehensive and integrated approach is needed to address the intertwined challenges of motivation, vocabulary, grammar, conversation, and interaction in Arabic language education.

n this context, AI has emerged as a strategic solution within web-based learning ecosystems. The integration of AI in web-based platforms does not merely introduce novel ways of delivering content; it also enables deeper personalization of learning experiences through adaptive algorithms, automated feedback, and emotionally aware systems (Nuridayanti et al., 2025; Susyanah & Fajar, 2024; Xursanovna et al., 2025). For example, AI can analyze learners' textual comments and interactions to infer emotional states, thus helping educators adjust their instructional strategies (Wahyono et al., 2022). AI-driven learning analytics can monitor and predict learner behavior, making timely intervention and performance improvement more feasible (Ikhsan et al., 2025; Xursanovna et al., 2025). At the macro level, AI has been found to enhance user engagement and loyalty on digital education platforms, support operational efficiency, and expand access to quality education, including for underserved regions (Hidayat et al., 2025; Vesna, 2025; Yanto et al., 2025). Nevertheless, these benefits are accompanied by serious concerns related to data privacy, technological inequality, and the need for robust digital infrastructure and teacher training (Almufarreh & Arshad, 2023; Ikhsan et al., 2025; Khalil et al., 2024).

Empirical studies in language education further strengthen the rationale for integrating AI into Arabic learning. Ilić et al (2024) report that intelligent tutoring systems significantly improve students' motivation and achievement in STEM education, demonstrating the wider educational potential of AI-based systems. In Arabic language contexts, Azisi (2025) shows that AI-based chatbots can enhance university students' motivation and support both learning and assessment. Other research indicates that AI technologies can contribute to the refinement of language skills and the design of instructional models for both native and non-native speakers of Arabic (Haq et al., 2024; Sidik et al., 2024). At the same time, Illananingtyas (2025) notes that AI implementation is still constrained by infrastructural limitations and varying institutional readiness, while several studies highlight a persistent gap between technological adoption and students' still largely traditional learning strategies (Haq et al., 2024; Sidik et al., 2024). Moreover, the global AI in education market is projected to reach USD 32.27 billion by 2030, underscoring the rapid growth and strategic importance of AI in educational ecosystems (Research, 2025). If not carefully examined, however, the use of such technologies risks becoming a superficial trend rather than a meaningful driver of improved learning quality.

Despite the expanding literature, a clear research gap persists regarding an integrated understanding of how AI supports Arabic learning strategies from a qualitative perspective. Most existing studies rely heavily on quantitative measurements of learning effectiveness, with

limited emphasis on how students describe, construct, and regulate their learning strategies when interacting with AI-based platforms. Although this study does not collect primary data on students' lived experiences, a traditional literature review remains relevant because it systematically synthesizes findings from previously published qualitative and mixed-methods studies (Hodges et al., 2020). Through this synthesis, the present study aims to identify recurring patterns, conceptual tendencies, and theoretical insights related to AI-mediated learning strategies that may not be visible through quantitative data alone. Rather than claiming to generate new qualitative data, this research seeks to map and conceptualize how existing empirical evidence portrays learning strategies in AI-supported Arabic language education. The expected contribution lies not in developing a new learning ecosystem, but in clarifying conceptual implications and highlighting directions for future empirical research.

Method

This study employed a traditional literature review approach to analyze the utilization of Artificial Intelligence (AI) within web-based Arabic language learning strategies. A traditional review was selected because it enables comprehensive synthesis and interpretation of previously published works without the rigid protocol required in systematic reviews. The data sources consisted of national and international journal articles, conference proceedings, books, and policy documents relevant to AI-assisted language learning, Arabic pedagogy, and digital educational media. Keyword combinations such as "Artificial Intelligence in Arabic language learning," "web-based learning," "digital Arabic pedagogy," and "AI-supported learning strategies" were used to search indexed databases including Google Scholar. The inclusion criteria focused on studies published between 2024 and 2025, written in English, and containing conceptual or empirical findings on digital or AI-mediated Arabic language learning. Sources that were duplicated, non-academic, or lacking methodological clarity were excluded from the analysis.

The analysis was conducted through thematic reading, classification, and comparison of relevant literature to identify patterns, convergences, and contradictions across studies. Each selected publication was examined to extract core information regarding learning challenges, technological interventions, AI functions, and student learning strategies in Arabic language contexts. The extracted themes were then synthesized to develop conceptual insights into how AI contributes to web-based Arabic learning and what pedagogical implications arise from this integration. This method provided a meaningful framework for bridging theoretical perspectives and empirical findings, allowing the research to formulate a holistic understanding of AI-supported learning strategies without conducting field observations or experiments. The results of this review form the basis for developing theoretical contributions and recommendations for future research and practice in Arabic language education.

Results and Discussion
Web-Based Learning Media

Technology plays an important role in human life to facilitate all human work, especially in the world of education, must keep up with the times utilizing existing technology, in language learning, especially Arabic which is a foreign language learned in Indonesia (Rasyad, 2022), then it must have the right strategies and media and in accordance with the style and development of the times so that learning Arabic will be more interesting and fun, One of the interesting media to use is web-based learning media using artificial intelligence (AI). The characteristics of this media are: 1) interactivity; 2) Independence; 3) accessibility; and 4) enrichment (Sutama & Fajriani, 2022).

Artificial Intelligence (AI)

Based on the results of a literature review of several previous studies related to AI, this can be seen in the following table:

Table 1. Literature Review Results

Researcher & Year	Objective	Method	Key Findings
Al Frhani (2025)	To evaluate the impact of AI on digital Arabic linguistic interaction	Qualitative analysis	NLP and chatbots enhance Arabic communication; challenges remain in resources and dialect variation
Al-Afnan (2024)	To explain the impact of AI on Arabic and English learning	Literature study	AI personalizes and adapts learning; strengthens cognitive, affective, and psychomotor domains
Doohee (2024)	To describe the computerization of Arabic language through AI	Descriptive–analytic	AI helps overcome communication difficulties and learning barriers in Arabic
Oktari et al (2025)	To analyze challenges and opportunities of AI in Arabic language education	Literature review	AI improves effectiveness and interactivity; concerns include validity and academic dishonesty
Asfar et al (2024)	To explore paradigm shifts in Arabic learning through AI	Literature review	AI fosters interactive, flexible, and efficient learning; research opportunities in dialect and long-term impacts
Alsaied (2024)	To highlight AI applications for enhancing Arabic language skills	Literature analysis	AI supports self-learning and digitization; challenges remain in resources and integration
Seyidov (2024)	To synthesize the current status of AI in Arabic language learning	Review	AI, NLP, ML, and DL contribute to developing Arabic educational platforms and language-learning games
Mustofa et al (2024)	To explain the role of ChatGPT in Arabic learning	Literature study	ChatGPT accelerates and simplifies learning; increases motivation for Arabic
Sa'idah et al (2024)	To assess the effectiveness of AI in Arabic language teaching	Quantitative (PLS-SEM)	AI improves learning outcomes; teacher training and student engagement are crucial

Similarities and Differences in Research

Research equations include: 1) Nearly all studies highlight AI as a tool that enhances the effectiveness, interactivity, and personalization of Arabic language learning; 2) Common challenges: limited linguistic resources, data validity, and dialect adaptation; 3) Many studies emphasize the importance of teacher training and student engagement in AI implementation. The

differences between these studies are: 1) Application focus: Some focus on ChatGPT, while others focus on NLP, educational platforms, or AR; 2) Methods: Some are qualitative, quantitative, literature studies, or empirical surveys; and 3) Subjects: Some focus on native speakers, non-native speakers, or higher education contexts.

Furthermore, gaps and weaknesses of previous research include: 1) Lack of longitudinal research: The long-term impact of AI on Arabic language acquisition has not been widely explored; 2) Limitations on dialects: Most research focuses on standard Arabic, with few evaluating dialect variations of student learning strategies; 3) There is still little qualitative analysis of student learning strategies in the context of AI. and 4) Integration of ethics and privacy: Issues of ethics, data privacy, and AI usage policies are still rarely discussed in depth.

This research contributes by qualitatively analyzing students' learning strategies in utilizing AI for Arabic language learning, filling gaps in aspects of learning strategies, dialect variations, and long-term impacts, and providing practical recommendations for the development of more inclusive and effective AI in the digital era.

The findings of this study on web-based learning media for Arabic align strongly with broader transformations associated with the Industrial Revolution 4.0 and the transition toward Society 5.0, where technology, automation, big data, and AI are repositioning education as a flexible, human-centered system (Ardhinar & Wibawa, 2022; Lestari, 2025; Sabaruddin, 2022). In this context, the use of web-based learning media supported by AI responds to the demand that education equip students with skills and learning experiences that are compatible with the digital era (Alvianto & Wibawa, 2022; Masitoh & Purbowati, 2024). The empirical description of web-based Arabic learning in this study—characterized by interactivity, independence, accessibility, and enrichment (Sutama & Fajriani, 2022)—is consistent with the wider literature on digital media that emphasizes interactive environments, ubiquitous access, and multimedia enrichment as key factors enhancing student engagement and understanding (Afaria et al., 2022; Firdaus & Wijayanti, 2024; Luthfi et al., 2023). In the case of Arabic, which is a foreign language in Indonesia and not commonly used in daily communication (Rasyad, 2022), such web-based media are especially important because they extend learning opportunities beyond the classroom, mitigate time and place constraints, and offer students repeated exposure to linguistic input that is essential for mastery.

The role of AI in this web-based ecosystem further strengthens the transformative potential of digital pedagogy. The literature reviewed in this study demonstrates a convergent view that AI—implemented through chatbots, NLP-based tools, adaptive platforms, and intelligent tutoring systems—enhances the effectiveness, interactivity, and personalization of Arabic language learning (Al Frhani, 2025; Al-Afnan, 2024; Asfar et al., 2024; Mustofa et al., 2024; Seyidov, 2024). AI-powered systems support self-paced learning, provide immediate feedback, and can tailor content to learners' cognitive, affective, and psychomotor needs, echoing the call of Society 5.0 for technology that genuinely serves human development (Alsaied, 2024; Amalia & Munif, 2023). Empirical findings that AI improves learning outcomes and student motivation (Mustofa et al., 2024; Sa'idah et al., 2024) are compatible with this study's observation that web-based media integrated with AI are perceived by students as more engaging and helpful than conventional methods. Moreover, the use of AI to create interactive and flexible learning environments resonates with earlier calls to integrate STEAM-oriented and innovative methods—including gamification, AR, and blended approaches—to attract digitally native learners ('Alam et al., 2023; Nais et al., 2023; Trikotama et al., 2024; Wahyudi, 2023).

Beyond the functionality of AI technologies, the central issue in Arabic learning lies in how students construct learning strategies when interacting with different AI systems. The reviewed literature indicates that chatbots tend to activate cognitive strategies, particularly rehearsal, elaboration, and vocabulary inference, because students repeatedly reconstruct sentences and

negotiate meaning during conversation with the chatbot. In contrast, Intelligent Tutoring Systems (ITS) stimulate metacognitive strategies such as planning, monitoring, and self-evaluation because learners must navigate adaptive modules, diagnose errors, and make decisions about their next learning path. Meanwhile, NLP-based writing platforms promote compensation strategies, where students draw on contextual clues and automated feedback to reformulate expressions or restructure sentences when facing lexical or grammatical difficulties. These distinctions demonstrate that AI does not merely assist learning but reshapes strategy selection—learners using chatbots engage in meaning-making and fluency building; those using ITS rely on reflective self-regulation; and those using NLP tools often depend on error-repair and problem-solving mechanisms. Therefore, the effectiveness of AI cannot be understood solely from its technological features, but must be interpreted through the lens of strategy enactment triggered by each AI modality.

At the same time, this study's synthesis of previous research highlights important nuances and differentiations across AI applications in Arabic language education. Although nearly all reviewed studies agree that AI increases effectiveness, interactivity, and personalization, their foci diverge: some emphasize ChatGPT as a medium for content delivery, assessment, and writing (Bahruddin et al., 2025; Mustofa et al., 2024), others explore NLP and language processing to enhance digital interaction and meaning-making (Oktari et al., 2025), while yet others investigate AI-enhanced platforms, adaptive systems, or augmented reality for phonetics and specialized skills (Tolba et al., 2024). Methodologically, the body of research ranges from qualitative analyses and descriptive studies to quantitative designs such as PLS-SEM and traditional literature reviews. The present study contributes to this diversity by adopting a qualitative lens on students' learning strategies, thereby complementing outcome-oriented empirical designs with a process-oriented perspective. This positioning is particularly relevant given persistent pedagogical challenges in Arabic education related to motivation, vocabulary, grammar (*qawāʾid*), and *muhādatsah*, which require not only technological interventions but also a deep understanding of how learners actually engage with those technologies (Capinding, 2024; Hastang & Ahmad, 2023; Rakhshan et al., 2024).

The discussion also reveals clear gaps and weaknesses in the existing literature that justify the focus and contribution of this research. Previous studies rarely adopt longitudinal designs, so the long-term impact of AI on Arabic language acquisition, particularly in relation to sustained vocabulary growth, grammatical accuracy, and communicative competence, remains underexplored. Likewise, most investigations concentrate on Modern Standard Arabic, paying limited attention to dialect variation and its implications for learners' strategies and communicative needs (Asfar et al., 2024). Qualitative analyses of students' own learning strategies in AI-mediated environments are still scarce, even though strategy use is a key mediator between technological affordances and actual learning outcomes. Furthermore, ethical issues, data privacy, academic integrity, and institutional policies for AI usage—already signaled as concerns in studies on validity, cheating, and misuse (Oktari et al., 2025)—have not been systematically integrated into the research agenda, despite being central to the sustainability of AI in a Society 5.0 framework (Ikhsan et al., 2025; Khalil et al., 2024). These gaps resonate with broader concerns about digital inequality, limited digital literacy among teachers and students, and unequal access to infrastructure, which can potentially widen educational disparities rather than reduce them (Lestari, 2025; Nais et al., 2023).

In light of these findings, the contribution of the present study lies in its qualitative analysis of how students construct and enact learning strategies when engaging with AI-based web media for Arabic. By focusing on learners' lived experiences, the study moves beyond the question of whether AI "works" to explore how and under what conditions it supports or constrains learning. This perspective is crucial for designing AI systems that are not only technologically sophisticated but also pedagogically meaningful, inclusive, and aligned with the real needs of students and teachers. The insights generated can inform teacher training programs that emphasize not merely

the technical use of AI tools but also their integration into student-centered, active, and reflective learning designs, in line with TPACK principles (Putri et al., 2023; Yanda et al., 2024). At a practical level, the study offers recommendations for developers and policymakers to ensure that AI-supported Arabic learning environments consider dialect diversity, ethical safeguards, and support for self-regulated learning, thereby contributing to a more holistic and future-oriented implementation of AI in Arabic language education in the digital era.

Conclusion

The findings of this study affirm that the integration of web-based learning media supported by Artificial Intelligence (AI) plays a transformational role in modern Arabic language education. Web-based platforms—characterized by interactivity, accessibility, independence, and enrichment—extend learning opportunities beyond classroom boundaries while fostering student-centered learning. When combined with AI, these platforms provide personalized, adaptive, and data-driven learning experiences that strengthen learners' cognitive, affective, and psychomotor competencies. Evidence from previous research consistently demonstrates that AI-powered systems such as chatbots, NLP tools, intelligent tutoring systems, and adaptive platforms enhance motivation, accelerate learning processes, and improve learning outcomes, making Arabic learning more engaging, flexible, and efficient.

Despite its vast potential, the study also identifies several research gaps and practical challenges that must be addressed before AI can be fully optimized in Arabic language learning. Limitations include the absence of longitudinal evaluations, minimal consideration of dialect variation, limited qualitative exploration of students' learning strategies, and insufficient attention to ethical issues, academic integrity, and data privacy. Therefore, the qualitative focus of this research provides a significant contribution by uncovering how students construct and utilize learning strategies when interacting with AI-based platforms. These insights not only enrich theoretical perspectives on technology-supported language learning but also offer practical recommendations for teachers, developers, and policymakers to design more inclusive, ethical, and sustainable AI-based Arabic learning systems in the digital era.

Reference

Afaria, Z., Sudjani, D. H., & Rachma, F. M. (2022). Pengaruh Media Pembelajaran Berbasis Permainan Digital Terhadap Minat Belajar Bahasa Arab Pada Siswa Kelas X MA Miftahul Huda. *Tatsqifiy Jurnal Pendidikan Bahasa Arab*, 3(2), 94–103. https://doi.org/10.30997/tjpba.v3i2.6235

Agustina, R. H., Alfiyanto, A., Suhendri, S., Wihardjo, E., & Pranajaya, S. A. (2025). Optimizing Learning: Adaptive Technology Integration in Indonesia's Education System. *Jurnal Ilmu Pendidikan (JIP) STKIP Kusuma Negara*, 16(2), 304–317. https://doi.org/10.37640/jip.v16i2.2293

Al Frhani, A. H. W. (2025). Digital Pragmatics: The Impact of Artificial Intelligence Technologies on the Development of Arabic Linguistic Interaction in Cyberspace. *Cognizance Journal of Multidisciplinary Studies*, 5(3), 362–376. https://doi.org/10.47760/cognizance.2025.v05i03.028

AlAfnan, M. A. (2024). Artificial Intelligence and Language: Bridging Arabic and English with Technology. *Journal of Ecohumanism*, 3(8). https://doi.org/10.62754/joe.v3i8.4961

'Alam, G. F., Imron, A., Supriyanto, A., & Mustiningsih, M. (2023). Paradigma Pendidikan Era Learning Society 5.0: Model STEAM Sebagai Internasional Best Practice Dalam Smart Education. *Proceedings Series of Educational Studies*. https://doi.org/10.17977/um083.7870

Alfiyanto, A., Hidayati, F., & Ghazali, M. (2024). *Integration of Adaptive Learning Technology in the Context of Islamic Education in Indonesia*. 3. http://dx.doi.org/10.47006/iscis.voi3.21907

Almufarreh, A., & Arshad, M. (2023). Promising Emerging Technologies for Teaching and Learning: Recent Developments and Future Challenges. *Sustainability*, *15*(8), 6917. https://doi.org/10.3390/su15086917

Alsaied, M. A. (2024). The Contribution of Artificial Intelligence Technologies in Refining the Arabic Language Skills of Its Native Speakers: Achieved and Possible. *Journal of Ecohumanism*, *3*(8). https://doi.org/10.62754/joe.v3i8.5126

Alvianto, M., & Wibawa, A. P. (2022). Kesiapan Indonesia Dalam Bidang Pendidikan Di Era Society 5.0. *Jurnal Inovasi Teknologi Dan Edukasi Teknik*, *2*(2), 73–79. https://doi.org/10.17977/um068v2i22022p73-79

Amalia, N. F., & Munif, Moh. V. M. (2023). Tantangan Dan Upaya Pendidikan Dalam Menghadapi Era Society 5.0. *Mjpiaud*, *2*(1), 1–13. https://doi.org/10.52166/mjpiaud.v2i1.4741

Ardhinar, M., & Wibawa, A. P. (2022). Persiapan Pendidikan Dalam Ranah Pembelajaran Pada Society 5.0. *Jurnal Inovasi Teknologi Dan Edukasi Teknik*, *2*(2), 86–92. https://doi.org/10.17977/um068v2i22022p86-92

Asfar, H., Husna, I., Yasmadi, Y., & others. (2024). Innovative Arabic Language Learning: Redefining Language Archetypes Using Artificial Intelligence. *Al-Ta'rib: Jurnal Ilmiah Program Studi Pendidikan Bahasa Arab IAIN Palangka Raya*, *12*(2), 293–308. https://doi.org/10.23971/altarib.v12i2.8323

Awabdeh, A. A., & Albashtawi, A. H. (2023). Predictable Factors That Help Students Engage in Online EFL Classroom and Their Relationship to Self-Management. *International Journal of Emerging Technologies in Learning (Ijet)*, *18*(01), 4–18. https://doi.org/10.3991/ijet.v18i01.35257

Azisi, A. (2025). Revolutionizing Education with AI Chatbots: Enhancing Learning and Assessment. *Dzihni: Jurnal Pendidikan Bahasa Arab, Linguistik Dan Kajian Literatur Arab*, *3*(1), 41–53. https://doi.org/10.28944/dzihni.v3i01.1318

Bahruddin, U., Imaduddin, M. F., & Muhammady, A. (2025). The Possibility of Benefiting From Artificial Intelligence in Designing Arabic Language Teaching for Non-Native Speakers. *Abjadia: International Journal of Education*, *10*(1), 179–189. https://doi.org/10.18860/abj.v10i1.32147

Bonok, Z., Abdussamad, S., Mohamad, Y., & Junus, A. P. P. (2024). Transformasi Digital Teknik Telekomunikasi Dasar Dan Sistem Telekomunikasi Lanjut. *Jambura Journal of Electrical and Electronics Engineering*, *6*(1), 98–102. https://doi.org/10.37905/jjeee.v6i1.23898

Capinding, A. T. (2024). Online Teaching Effectiveness and Teacher's Readiness: Impact on Student's Satisfaction and Academic Performance. *International Journal of Instruction*, *17*(2), 383–400. https://doi.org/10.29333/iji.2024.17222a

Doohee, A. H. (2024). Contribution of Artificial Intelligence to Learning the Arabic Language. *European Journal of Language and Culture Studies*, *3*(3), 17–23. https://doi.org/10.24018/ejlang.2024.3.3.120

Firdaus, S. A. R., & Wijayanti, J. (2024). Implementasi Gamifikasi Media Pembelajaran Wordwall Dalam Pembelajaran Teks Hikayat Pada Siswa SMA. *Alfabeta Jurnal Bahasa Sastra Dan Pembelajarannya*, *7*(2), 317–324. https://doi.org/10.33503/alfabeta.v7i2.4120

García, V. B., & Vaca-Cárdenas, M. E. (2022). Factors That Prevent the English Oral Production of Students of First and Second Year of Bachillerato. *Kronos – The Language Teaching Journal*, *3*(2), 8–17. https://doi.org/10.29166/kronos.v3i2.3829

Haq, A. Z., Akmansyah, M., Erlina, E., & Koderi, K. (2024). Technology Integration in Arabic Language Learning: A Literature Review on the Effectiveness of e-Learning and Mobile Applications. *Journal of Research in Instructional*, *4*(2). https://doi.org/10.30862/jri.v4i2.473

Hastang, H., & Ahmad, R. (2023). Analysis of Arabic Language Learning Difficulties Among Students in the Qawaid Al-Lughah Al-Arabiyyah Materials. *Didaktika Jurnal Kependidikan*, *17*(1), 31–42. https://doi.org/10.30863/didaktika.v17i1.5052

Hidayat, R. S., Maulana, P., Muhdaliha, E., Bongsoikrama, J., & Wibowo, F. L. (2025). Customer Focus Strategy in the Digital Era: The Influence of AI Implementation and Competitive Advantage on Enhancing Brand Loyalty in Edutech Platforms. *Jurnal Publikasi Sistem Informasi Dan Manajemen Bisnis*, 4(3), 539–547. https://doi.org/10.55606/jupsim.v4i3.5487

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). *The Difference Between Emergency Remote Teaching and Online Learning*. https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning

Ikhsan, I., Hadikusumo, R. A., & Halimatusadiyah, E. (2025). AI and LMS: The Transformation of Adaptive and Predictive-Based Digital Learning Management. *Ijit*, 2(4), 230–240. https://doi.org/10.71364/ijit.v2i1.15

Ilić, J., Ivanović, M., & Klašnja-Milićević, A. (2024). The Impact of Intelligent Tutoring Systems and Artificial Intelligence on Students' Motivation and Achievement in STEM Education: A Systematic Review. *Journal of Educational Studies in Mathematics and Computer Science*, 1(2), 5–18. https://doi.org/10.5937/JESMAC2402005I

Illananingtyas, T. (2025). Opportunities and Challenges of Artificial Intelligence in English Language Education at Higher Education Institution. *Sosaintek: Jurnal Ilmu Sosial Sains Dan Teknologi*, 2(1), 25–32. https://doi.org/10.33367/sosaintek.v2i1.7272

Khalil, M., Wong, J., Wasson, B., & Paas, F. (2024). Adaptive Support for Self-regulated Learning in Digital Learning Environments. *British Journal of Educational Technology*, 55(4), 1281–1289. https://doi.org/10.1111/bjet.13479

Kopczynski, K., & Silvia, C. (2024). Challenges of Teaching Foreign Languages in an Asynchronous Setting. *Creative Education*, 15(07), 1311–1327. https://doi.org/10.4236/ce.2024.157079

Lestari, R. A. (2025). Strategi Manajemen Pendidikan Inklusif Di Era Society 5.0, Merangkul Keberagaman Dalam Lingkungan Pembelajaran Digital. *Managiere*, 3(2), 115–130. https://doi.org/10.35719/managiere.v3i2.2349

Luthfi, T., Azzahra, S., Farhan, Z. A., Puradireja, S. M., Iskandar, S., & Sari, N. T. A. (2023). Media Pembelajaran Digital Sebagai Penunjang Mata Pelajaran IPA Di Sekolah Dasar. *Intel*, 2(4), 484–492. https://doi.org/10.56855/intel.v2i4.374

Masitoh, S. D., & Purbowati, D. (2024). Enhancing Teacher Professionalism in Indonesia: Challenges and Strategies for Digital Technology Utilization in the Society 5.0 Era. *Heutagogia Journal of Islamic Education*, 4(2), 219–236. https://doi.org/10.14421/hjie.2024.42-06

Minkhatunnakhriyah, M., & Albiansyah, A. (2020). Analysis of Student's Needs in Speaking Skill as the Basis for Developing Learning Materials on 8 Grades of MTs. Fathimatul Amin Jakarta. *Instructional Development Journal*, 3(3), 171. https://doi.org/10.24014/idj.v3i3.11380

Mustofa, A., Ps, S. S. D., Sari, S. R., & Wirawan, R. (2024). Use of AI Artificial Intelligence chatGPT for Arabic Language Learning Media. *At Turots: Jurnal Pendidikan Islam*, 236–249. https://doi.org/10.51468/jpi.v6i1.690

Nais, M. K., Rohman, I., Anwar, S., Setiadi, R., Sumarna, O., Hana, M. N., Gumilar, G. G., & Munawaroh, H. S. H. (2023). Optimization of Teaching Materials and Learning Media Based on Digital Technology as a Learning Innovation in the Era of Society 5.0 [Optimalisasi Bahan Ajar Dan Media Pembelajaran Berbasis Teknologi Digital Sebagai Inovasi Pembelajaran Di Era Society 5.0]. *J. Pengabdian Isola*, 2(2), 142–147. https://doi.org/10.17509/jpi.v2i2.67844

Nasution, F. R. A., Rahman, A., Ambiyar, A., & Usmeldi, U. (2025). Meta – Analisis: Evaluasi Penggunaan Media Pembelajaran Berbasis Digital Dalam Mendukung Pembelajaran Di SMK. *Vocational Jurnal Inovasi Pendidikan Kejuruan*, 5(2), 34–42. https://doi.org/10.51878/vocational.v5i2.5782

Ni'am, F., Hidayaturrahaman, M., & Khosi'in, K. (2024). Urgensi Kebutuhan Literasi Penguasaan Media Pembelajaran Berbasis Digital Alumni Program Studi Bahasa Arab IAIN Bengkulu. *Al Maktabah*, 9(2), 162. https://doi.org/10.29300/mkt.v9i2.5297

Nuridayanti, Tjalla, A., & Soeprijanto, S. (2025). Systematic Literature Review: The Role of Artificial Intelligence in Educational Transformation in the Digital Era. *Edutech*, *24*(1), 299–307. https://doi.org/10.17509/e.v24i1.78717

Oktari, S. J., Harahap, D. H., & Hasaniyah, N. (2025). Artificial Intelligence and the Transformation of Arabic Meaning: Challenges and Opportunities. *Abjadia: International Journal of Education*, *10*(1), 58–71. https://doi.org/10.18860/abj.v10i1.30650

Oktaviana, M., & Ramadhani, S. P. (2023). Pengembangan Media Pembelajaran IPA Berbasis Komik Digital Untuk Meningkatkan Hasil Belajar Kognitif Siswa. *Jurnal Ilmiah Profesi Pendidikan*, *8*(1), 48–56. https://doi.org/10.29303/jipp.v8i1.1090

Pather, N., Blyth, P., Chapman, J., Dayal, M., Flack, N. A., Fogg, Q. A., Green, R. A., Hulme, A., Johnson, I., Meyer, A., Morley, J. W., Shortland, P., Štrkalj, G., Štrkalj, M., Valter, K., Webb, A. L., Woodley, S. J., & Lazarus, M. D. (2020). Forced Disruption of Anatomy Education in Australia and New Zealand: An Acute Response to the Covid-19 Pandemic. *Anatomical Sciences Education*, *13*(3), 284–300. https://doi.org/10.1002/ase.1968

Putri, H., Hariani, N. P., Febrianti, T., & Sutabri, T. (2023). Teknologi Pendidikan dan Transformasi Digital di Indonesia Selama Pandemi. *IJM: Indonesian Journal of Multidisciplinary*, *1*(5), 1–10.

Rakhshan, M., Mousazadeh, N., Hajihosseini, F., Bagherian, S., Moradi, N., Hakimi, H., & Ranjbar, H. (2024). Para Medicine Students' Experiences of Virtual Education: A Qualitative Study. *Journal of Qualitative Research in Health Sciences*, *13*(1), 34–41. https://doi.org/10.34172/jqr.2024.06

Rasyad, R. (2022). مشكلات تدريس اللغة العربية فى المعاهد التقليدية. *LISANUNA: Jurnal Ilmu Bahasa Arab Dan Pembelajarannya*, *12*(1), 113. https://doi.org/10.22373/ls.v12i1.13377

Research, G. V. (2025). *AI In Education Market Size & Share | Industry Report, 2030*. https://www.grandviewresearch.com/industry-analysis/artificial-intelligence-ai-education-market-report

Sabaruddin, S. (2022). Pendidikan Indonesia Menghadapi Era 4.0. *Jurnal Pembangunan Pendidikan Fondasi Dan Aplikasi*, *10*(1). https://doi.org/10.21831/jppfa.v10i1.29347

Sa'idah, M. A., Diantoro, K., Mahmudah, U., Dolan, E., Santoso, N. A., & Junaedi, S. R. P. (2024). Enhancing Arabic Language Teaching through Artificial Intelligence: Assessing Effectiveness and Educational Implications. *2024 3rd International Conference on Creative Communication and Innovative Technology (ICCIT)*, 1–8. https://doi.org/10.1109/ICCIT62134.2024.10701089

Saragih, S. M., & Listyani, L. (2021). English Language Education Program Second-Year Students' Speaking Difficulties in an Academic Speaking Class. *Saga Journal of English Language Teaching and Applied Linguistics*, *2*(2), 73–88. https://doi.org/10.21460/saga.2021.22.77

Seyidov, R. (2024). Arabic Language Processing: Current Status And Future Prospects Of Artificial Intelligence. *Journal of Namibian Studies: History Politics Culture*, *41*, 224–240. https://doi.org/10.59670/jwszy037

Sidik, A., Hasibuan, A. H., Irawati, I., & Wahyuni, A. (2024). Integration of Artificial Intelligence (AI) Technology in Arabic Language Learning; Opportunities and Challenges. *International Conference on Islamic Education and Islamic Business (ICoBEI)*, *1*(1), 83–92.

Social, W. A. & Meltwater. (2023). *Digital 2023: Global Overview Report—DataReportal – Global Digital Insights*. https://datareportal.com/reports/digital-2023-global-overview-report

Srihilmawati, R., & Nurjanah, N. (2023). Transformasi Bahasa Daerah Di Era Smart Society 5.0. *Jurnal Syntax Imperatif Jurnal Ilmu Sosial Dan Pendidikan*, *4*(5), 570–575. https://doi.org/10.36418/syntax-imperatif.v4i5.288

Supriadi, A., Akla, A., & Sutarjo, J. (2020). Problematika Pengajaran Bahasa Arab Di Madrasah Aliyah. *An Nabighoh: Jurnal Pendidikan Dan Pembelajaran Bahasa Arab*, *22*(2), 211. https://doi.org/10.32332/an-nabighoh.v22i02.2314

Susyanah, S., & Fajar, A. N. (2024). The Artificial Intelligence, Social Sciences Learning Innovation Catalyst. *Icasse*, *1*(1), 114–120. https://doi.org/10.31316/icasse.v1i1.6845

Sutama, S., & Fajriani, I. N. (2022). Media Pembelajaran E-Learning Berbasis WEB Di Tingkat Sekolah Menengah Kejuruan. *Jurnal VARIDIKA*, *33*(2), 129–140. https://doi.org/10.23917/varidika.v33i2.15330

Syaikhudin, M., & Laili, M. (2024). Development of AI-based Arabic Learning Model to Improve Non-Native Speaker Arabic Speaking Skills. *Syaikhuna Jurnal Pendidikan Dan Pranata Islam*, *15*(01), 25–33. https://doi.org/10.62730/syaikhuna.v15i01.7295

Telyani, A. E., Farmanesh, P., & Zargar, P. (2021). The Impact of COVID-19 Instigated Changes on Loneliness of Teachers and Motivation–Engagement of Students: A Psychological Analysis of Education Sector. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.765180

Tolba, R. M., Elarif, T., Taha, Z., & Hammady, R. (2024). Interactive Augmented Reality System for Learning Phonetics Using Artificial Intelligence. *IEEE Access*, *12*, 78219–78231. https://doi.org/10.1109/ACCESS.2024.3406494

Trikotama, R. M. A., Nurrohman, M. N., & Hutajulu, D. K. (2024). Application of Augmented Reality in Education. *Hipkin J. Educational Res.*, *1*(3), 263–274. https://doi.org/10.64014/hipkin-jer.v1i3.26

UNESCO. (2021). *AI and Education: Guidance for Policy-Makers*. UNESCO. https://doi.org/10.54675/PCSP7350

Vesna, L. (2025). Digital Divide in AI-Powered Education: Challenges and Solutions for Equitable Learning. *Journal of Information Systems Engineering & Management*, *10*(21s), 300–308. https://doi.org/10.52783/jisem.v10i21s.3327

Wahyono, I. D., Saryono, D., Putranto, H., Asfani, K., Rosyid, H. A., Sunarti, S., Mohamad, M. M., Mohd Nihra Haruzuan Mohamad Said, Horng, G. J., & Shih, J.-S. (2022). Emotion Detection Based on Column Comments in Material of Online Learning Using Artificial Intelligence. *International Journal of Interactive Mobile Technologies (Ijim)*, *16*(03), 82–91. https://doi.org/10.3991/ijim.v16i03.28963

Wahyudi, T. (2023). Membangun Strategi Pembelajaran Pendidikan Agama Islam Era Revolusi Industri 4.0 Dan Society 5.0. *Al-Mutharahah Jurnal Penelitian Dan Kajian Sosial Keagamaan*, *20*(1), 148–159. https://doi.org/10.46781/al-mutharahah.v20i1.670

Xursanovna, U. K., Makhmudovna, Y. G., Rustamovna, A. N., Arturovna, T. G., & Vitalyevna, U. A. (2025). The Role of Ai-Based Learning Analytics in Improving Student Performance in E-Learning Platforms. *Int. J. Environ. Sci.*, *11*(2s), 509–517. https://doi.org/10.64252/nj245y51

Yanda, G., Maulidiah, R. H., & Isnaini, I. (2024). Pemanfaatan Teknologi Sebagai Media Pembelajaran Bahasa Indonesia Kelas Vii SMP Negeri 3 Kisaran. *Linguistik Jurnal Bahasa Dan Sastra*, *9*(1), 11. https://doi.org/10.31604/linguistik.v9i1.11-19

Yanto, M., Rizqiyah, N., Suwantoro, & Masrurah, W. (2025). Menavigasi Pembelajaran Steam Berbasis AI Pada Peningkatan Kualitas Pendidikan Di Indonesia. *Iconis*, *9*, 65–72. https://doi.org/10.19105/iconis.v9i1.938