METHODS OF ARABIC LANGUAGE LEARNING IN THE DIGITAL ERA: A SYSTEMATIC LITERATURE REVIEW ON THE EFFECTIVENESS OF TECHNOLOGY IN TEACHING THE FOUR SKILLS

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ABSTRACT

This systematic literature review examines the effectiveness of digital technology in teaching the four Arabic language skills (maharah empat) consisting of listening, speaking, reading, and writing. The research aims to identify and classify types of technology used in Arabic language learning, analyze their effectiveness on each language skill, and formulate best practice recommendations for technology integration. Using a qualitative approach with systematic literature review design, this study analyzed 63 peer-reviewed articles published between 2015-2024 from databases including Scopus, Web of Science, ERIC, ProQuest, and Google Scholar. Thematic content analysis was employed following Braun and Clarke's framework to identify patterns and themes. The findings reveal six main technology categories: mobile learning applications, e-learning platforms, gamification technology, speech recognition and pronunciation technology, virtual and augmented reality, and computer-assisted writing tools. Technology demonstrates highest effectiveness for listening skills with 42% improvement, followed by reading skills (45%), speaking skills (38%), and writing skills (33%), indicating stronger support for receptive skills compared to productive skills. Five critical contextual factors influencing technology effectiveness were identified: teacher digital literacy, instructional design quality, student technology readiness, sociocultural context and attitudes, and duration and intensity of use. The research concludes that technology is most effective when functioning as a complement to human instruction rather than a replacement, requiring integration within clear pedagogical frameworks and supported by qualified teachers with strong TPACK competencies. This study contributes to Arabic language pedagogy by providing a comprehensive evidence-based framework for technology integration and identifying priority areas for future research, particularly emerging technologies such as VR/AR and AI-based learning systems.

Keywords: Arabic language learning, digital technology, maharah empat, systematic literature review, educational technology, language skills

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A. INTRODUCTION

Arabic language learning as a foreign language has undergone significant transformation in recent decades, particularly with the penetration of digital technology in education. Internationally, the integration of technology in Arabic language learning has become a major focus of pedagogical research, considering that Arabic is one of the most widely spoken languages in the world with more than 400 million native speakers and plays an important role in religious, economic, and global political contexts (Al-Khatib, 2019). The development of digital-based language learning technologies such as mobile applications, e-learning platforms, gamification, and artificial intelligence has opened new opportunities to enhance the effectiveness of mastering the four language skills or maharah empat, which include listening (istima'), speaking (kalam), reading (qira'ah), and writing (kitabah) (Hassan & Ahmed, 2020).

In Indonesia, Arabic language learning has unique characteristics because it is not only learned as a foreign language but also has a strong religious dimension in the context of Islamic education (Munir, 2018). According to data from the Ministry of Religious Affairs of the Republic of Indonesia, there are more than 30,000 madrasas and Islamic boarding schools that teach Arabic as a mandatory subject, as well as thousands of universities that offer Arabic Language Education study programs (Hidayat, 2021). However, challenges in Arabic language learning in Indonesia remain quite complex, including limitations in learning media, varying teacher competencies, low student motivation, and minimal exposure to the use of Arabic contextually outside the classroom (Rosyidi & Ni'mah, 2019). The digital era brings fresh air by offering various technological solutions that can overcome these obstacles, ranging from adaptive learning applications, online learning platforms, to virtual reality technology that enables simulation of Arabic-speaking environments (Fahmi, 2020).

Previous research on technology in Arabic language learning has shown diverse results. A study by Abdallah (2018) found that the use of mobile learning applications can increase student learning motivation by 35% in learning Arabic vocabulary. Meanwhile, research by Zainuddin and Ahmad (2017) demonstrated that gamification-based learning platforms can improve reading comprehension skills by 28% compared to conventional methods. However, research by Rahman and Sulaiman (2019) revealed that the effectiveness of technology depends heavily on appropriate instructional design and teacher competence in utilizing digital tools. Furthermore, a meta-analysis study by Al-Qahtani (2020) involving 45 experimental studies showed varying effect sizes, indicating that not all types of technology provide the same impact on each language skill. This reveals a research gap regarding which types of technology are most effective for each of the four Arabic language skills, as well as what contextual and pedagogical factors influence the effectiveness of technology implementation in Arabic language learning.

This research aims to address these gaps through three specific objectives. First, to identify and classify various types of digital technology used in teaching the four Arabic language skills based on recent literature. Second, to analyze the effectiveness of each type of technology on each maharah based on empirical findings from various research contexts. Third, to formulate recommendations regarding best practices for integrating technology in Arabic language learning based on synthesis of existing evidence.

This research is expected to provide significant contributions to the development of Arabic language pedagogy in the digital era. Theoretically, this study will enrich the understanding of the relationship between technology, pedagogy, and Arabic language learning outcomes through a comprehensive and systematic framework. Practically, the findings of this research can serve as guidelines for educators, curriculum developers, and educational policymakers in selecting and implementing appropriate technology to enhance the quality of Arabic language learning. Methodologically, this systematic literature review will provide a replicable model for similar studies in other language learning contexts, as well as identify priority areas for future empirical research. In the Indonesian context specifically, this research is expected to assist in optimizing the use of technology in thousands of Islamic educational

institutions that teach Arabic, thereby supporting national efforts to improve the quality of foreign language education and strengthen the position of Arabic as an important international language.

B. METHODS

This research employs a qualitative approach with systematic literature review design to comprehensively examine the phenomenon of technology use in Arabic language learning. A qualitative approach is chosen because this research aims to understand, describe, and interpret patterns, themes, and meanings that emerge from various studies that have been conducted, rather than testing hypotheses or measuring causal relationships quantitatively (Creswell & Poth, 2018). This approach allows researchers to explore the complexity and context of technology implementation in Arabic language learning holistically and in-depth.

The type of research used is systematic literature review, which is a structured and replicable research method for identifying, evaluating, and synthesizing all relevant research findings on specific questions or topics (Snyder, 2019). Systematic literature review differs from traditional narrative review because it follows explicit and transparent protocols to minimize bias and ensure research comprehensiveness. This type was chosen because it can provide a comprehensive picture of the state of knowledge regarding technology in Arabic language learning, identify patterns and gaps in existing research, and produce evidence-based conclusions.

The research subjects in this literature review are scientific articles published in international and national journals during the period 2015-2024. Inclusion criteria include articles that discuss the use of digital technology in teaching one or more of the four Arabic language skills, published in peer-reviewed journals, available in full text, and written in English or Arabic. Exclusion criteria include articles that only discuss technology in general without specific context of Arabic language learning, proceedings or non-peer-reviewed publications, and articles that do not report clear empirical findings. Through initial searches on databases including Scopus, Web of Science, ERIC, ProQuest, and Google Scholar using keywords "Arabic language learning," "digital technology," "maharah," "language skills," and variations thereof, 287 potentially relevant articles were identified. After the screening process based on inclusion and exclusion criteria, 63 articles were selected for in-depth analysis.

The data collection technique used is systematic documentation study through several stages. First, database searching is conducted using specific keywords and Boolean operators to ensure comprehensive coverage. Second, screening is performed in two stages, namely screening based on titles and abstracts followed by screening based on full text. Third, quality assessment of each selected article is conducted using standardized instruments such as the Critical Appraisal Skills Programme (CASP) to ensure that only quality studies are included in the analysis. Fourth, relevant data extraction from each article includes research characteristics such as year, research location, research design, type of technology used, target language skills, sample size, findings, and conclusions. All data are recorded in a data extraction matrix designed specifically for this research to facilitate systematic analysis.

The data analysis technique used is thematic content analysis following the stages proposed by Braun and Clarke (2020). First, the familiarization stage where researchers read all selected articles repeatedly to gain deep understanding. Second, initial coding where researchers identify and label important information relevant to research objectives. Third, theme searching where codes are grouped into potential themes based on patterns that emerge. Fourth, theme review where researchers evaluate and refine themes to ensure they are coherent and distinctive. Fifth, theme definition and naming where researchers define and name each final theme clearly. Sixth, report writing where researchers present analysis findings narratively supported by quotations and evidence from analyzed articles. This analysis process is conducted iteratively and reflexively, where researchers continuously move between data and emerging themes to

ensure interpretation validity. To ensure analytical rigor, intercoder reliability checks are performed where two researchers independently code a sample of articles and then compare results to achieve consistency.

Research ethics in this systematic literature review are maintained through several principles. First, transparency and replicability where all research stages from search strategies, selection criteria, to analysis processes are documented in detail so they can be replicated by other researchers. Second, intellectual honesty where all sources are cited appropriately and there is no plagiarism or improper appropriation of other researchers' ideas. Third, objectivity and impartiality where researchers strive to minimize personal bias by following systematic protocols and not selectively selecting articles that only support certain hypotheses. Fourth, acknowledgment of limitations where researchers openly acknowledge any methodological limitations and potential biases in the research. Fifth, although this research does not involve direct human subjects, ethical principles are still applied in treating the work and intellectual contributions of original authors with respect and appreciation. This research has also received ethical approval from the Research Ethics Committee of the institution where the research was conducted, ensuring that the entire research process complies with applicable scientific and ethical standards

C. RESULTS

The first finding of this research relates to the identification and classification of various types of digital technology used in teaching the four Arabic language skills. Based on analysis of 63 articles, six main categories of technology emerged as dominant in Arabic language learning. First, mobile learning applications such as Duolingo Arabic, Memrise, and ArabicPod101 which are most frequently used for vocabulary learning and listening skill development, reported in 28 articles with an average effectiveness rate of 72% (Al-Emran & Shaalan, 2021). Second, e-learning platforms such as Moodle, Edmodo, and Google Classroom which are primarily used for integrated learning management and providing learning materials for all four skills, appearing in 19 articles with user satisfaction levels ranging from 65% to 85% (Ibrahim & Hassan, 2018). Third, gamification technology including Kahoot, Quizizz, and specially designed Arabic language learning games that focus on enhancing motivation and vocabulary retention through game elements, discussed in 15 articles with motivation increase reaching 40-60% (Mahmoud & Tanni, 2022). Fourth, speech recognition and pronunciation technology such as Rosetta Stone Arabic and various AI-based pronunciation applications that specifically target speaking skills, found in 12 articles with pronunciation accuracy improvement of 35-50% (Alqahtani, 2019). Fifth, virtual and augmented reality technology that creates immersive Arabic-speaking environments, still relatively new with only 6 articles but showing very promising results with engagement rates exceeding 90% (Bin Dahmash, 2020). Sixth, computer-assisted writing tools including grammar checkers and automatic writing feedback systems that support the development of writing skills, reported in 11 articles with error reduction of 25-45% (Khatter, 2021). This distribution shows that mobile applications and e-learning platforms dominate research, while more innovative technologies such as VR/AR are still in early stages of exploration.

The second finding examines the effectiveness of each type of technology on each maharah based on empirical findings from various research contexts. For listening skills (istima'), mobile learning applications and podcast-based platforms show the highest effectiveness with an average improvement of 42% in listening comprehension tests (Al-Jarf, 2020). Technology features that support listening skills include subtitles in Arabic and transliteration, adjustable playback speed, and repeated listening facilities that allow students to learn at their own pace. Research by Khafaga (2021) found that students using mobile applications for listening exercises 30 minutes daily for 12 weeks showed significant improvements compared to control groups using conventional methods. For speaking skills (kalam), speech recognition technology and

chatbot applications demonstrate strong effectiveness with pronunciation improvement reaching 38% and speaking fluency increasing by 30% (Salem, 2018). These technologies provide immediate feedback that allows students to directly correct their pronunciation errors, something that is often limited in traditional classroom settings. Research by Alzubi (2019) revealed that students using AI-based speech recognition applications gain higher confidence in speaking Arabic because they can practice privately without fear of embarrassment. For reading skills (qira'ah), e-learning platforms with interactive reading features and reading applications with dictionary integration show effectiveness of 45% in reading comprehension improvement and 52% in reading speed (Rahman & Abdullah, 2019). Adaptive features that adjust text difficulty levels to student abilities are reported as particularly effective factors. For writing skills (kitabah), computer-assisted writing tools and platforms with automatic feedback show effectiveness of 33% in reducing grammatical errors and 28% in improving text coherence (Hassan & Alkhateeb, 2020). However, research also notes that these technologies are most effective when combined with teacher guidance, not as complete replacement of human instruction.

The third finding relates to contextual and pedagogical factors that influence the effectiveness of technology implementation in Arabic language learning. Analysis identified five critical factors. First, the level of teacher digital literacy proves to be the most influential determinant, where research shows that technology implementation by teachers with high digital competence produces learning outcomes 58% better than implementation by teachers with limited digital competence (Alharbi, 2019). Teachers who can effectively integrate technology into instructional design, provide appropriate guidance to students, and utilize technological features optimally produce significantly better outcomes. Second, instructional design and pedagogy, where research consistently shows that technology is most effective when integrated into clear pedagogical frameworks such as task-based learning, blended learning, or flipped classroom, rather than used merely as supplements without clear instructional design (Al-Kathiri, 2021). Third, the level of student technology readiness including their access to devices, internet connectivity, and digital skills, significantly affects learning outcomes, where students with better access and digital skills benefit 45% more from technology-based learning (Alasmari & Ahmed, 2020). Fourth, sociocultural context and student attitudes toward technology and Arabic language learning, where research in contexts with positive attitudes toward technology and strong intrinsic motivation to learn Arabic show better outcomes than contexts with negative attitudes or only extrinsic motivation (Alfadda & Mahdi, 2021). Fifth, duration and intensity of technology use, where research indicates that consistent and regular use (minimum 3-4 times per week with 20-30 minutes duration) produces better results than sporadic or excessive use, indicating the importance of balance in technology integration (Albiladi & Alshareef, 2019).

D. DISCUSSION

The first interpretation of this research's findings relates to the theoretical understanding of how technology supports Arabic language learning from a constructivist and connectivist perspective. Findings showing the dominance of mobile applications and e-learning platforms in Arabic language learning reflect a fundamental shift from teacher-centered learning paradigms to student-centered and personalized learning. In the framework of constructivist theory proposed by Vygotsky, digital technology serves as a cognitive tool that expands the zone of proximal development for Arabic language learners (Lantolf & Thorne, 2018). Mobile applications that provide immediate feedback, adaptive exercises, and multimodal content enable students to construct their language knowledge more actively and independently. Meanwhile, from a connectivist perspective, e-learning platforms and social learning technologies facilitate the formation of learning networks where students can connect with Arabic-speaking communities globally, access authentic resources, and participate in collaborative learning, all of which are highly relevant to foreign language acquisition (Siemens & Conole, 2021). The high effectiveness of technology on listening and reading skills compared to speaking and writing

skills can be interpreted through input hypothesis theory from Krashen, where digital technology excels in providing comprehensible and diverse input, but still requires human mediation for optimal productive skill development (VanPatten & Williams, 2022). This explains why speaking and writing skills, which require more complex interactional and corrective feedback, show relatively lower effectiveness when technology is used without adequate teacher involvement.

The second interpretation addresses the practical implications of contextual factors influencing technology effectiveness. Findings showing digital teacher literacy as the most critical determinant confirm the TPACK (Technological Pedagogical Content Knowledge) framework which posits that effective technology integration requires the intersection of three types of knowledge, namely technology knowledge, pedagogical knowledge, and content knowledge (Koehler & Mishra, 2020). In the context of Arabic language learning, teachers not only need to master how to operate technology, but also understand Arabic pedagogy and how to integrate technology into instructional strategies that are appropriate for specific language learning objectives. This has important implications for Arabic language teacher professional development programs, which must prioritize building TPACK competencies through training that integrates technical skills with Arabic pedagogical understanding. The significant influence of instructional design also confirms the Substitution Augmentation Modification Redefinition (SAMR) model, which suggests that technology has the greatest impact when it enables redefinition of learning tasks that were previously impossible, not merely as substitution for conventional methods (Puentedura, 2019). Arabic language learning that utilizes VR/AR to create immersive simulations of Arabic-speaking environments, or uses AI to provide personalized adaptive learning, represents the highest level in the SAMR model and therefore shows the most promising results despite still being limited in implementation. Meanwhile, sociocultural factors and student attitudes reinforce the importance of understanding learner characteristics and local contexts in technology implementation, where one-size-fits-all approaches often fail to produce optimal results (Warschauer & Matuchniak, 2021).

The third interpretation concerns emerging patterns from comparative analysis between types of technology and specific language skills. The high correlation between mobile applications and vocabulary/listening skill development reflects the nature of these technologies that support microlearning and spaced repetition, two principles that are scientifically proven effective for vocabulary memorization and listening comprehension (Godwin-Jones, 2018). Likewise, the effectiveness of speech recognition technology for speaking skills demonstrates how artificial intelligence can provide aspects of learning that are traditionally limited in classroom contexts, namely unlimited pronunciation practice opportunities with immediate feedback without social pressure (Shadiev & Yang, 2020). However, the lower effectiveness of technology for writing skills compared to other skills raises important questions about the limitations of current technologies in assessing complex dimensions of writing such as discourse organization, stylistic appropriateness, and pragmatic competence, which still require human evaluator expertise (Warschauer & Grimes, 2023). This suggests that future technology development needs to focus on more sophisticated natural language processing capabilities specific to Arabic that can assess these deeper dimensions of writing. Furthermore, the finding that technology effectiveness increases significantly when combined with teacher guidance reinforces the theory of complementary roles between technology and human instruction, where technology excels in providing practice, exposure, and immediate feedback, while teachers excel in providing contextualization, complex explanations, affective motivation, and metacognitive guidance (Chun et al., 2021).

This research makes several significant contributions to the field of Arabic language pedagogy and educational technology. First, it provides the first comprehensive systematic synthesis of evidence regarding technology effectiveness for each specific Arabic language skill, filling the knowledge gap that previously existed due to research fragmentation. Second, this

research offers a contextual framework that helps practitioners understand that technology effectiveness is not universal but depends on various contextual and pedagogical factors, thereby providing more realistic and applicable guidance. Third, theoretically, this research contributes to refining technology integration models in language learning by demonstrating the importance of differentiating approaches for receptive skills versus productive skills, as well as highlighting the irreplaceable role of qualified teachers in maximizing technology benefits. Fourth, practically, the classification of six types of technology with their respective characteristics provides a practical guide for Arabic language educators in selecting appropriate technology for their specific learning objectives and contexts. Fifth, this research identifies priority areas for future research, particularly more innovative technologies such as VR/AR and AI that show high potential but are still limited in empirical studies, as well as the need for longitudinal research to examine the long-term effects of technology use in Arabic language learning.

This research has several important limitations that need to be acknowledged. First, this literature review is limited to articles published in English and Arabic, which may exclude relevant research published in other languages, potentially causing publication bias. Second, although systematic protocols are used, the literature selection and analysis process still involves researcher subjective interpretation, particularly in thematic categorization and interpretation of findings from studies with different methodologies. Third, the majority of analyzed articles are quantitative studies with relatively short durations, so this research cannot provide comprehensive insights into long-term processes and impacts of technology use in Arabic language learning. Fourth, heterogeneity in research designs, measurement instruments, and reporting of results across analyzed studies makes direct meta-analytical comparison difficult, so this research relies more on narrative synthesis which has inherent limitations. Fifth, most research analyzed is conducted in Middle Eastern or developed country contexts, with relatively little representation from Southeast Asian contexts including Indonesia, thus limiting the generalizability of findings to more diverse contexts. Sixth, this research focuses more on learning outcomes and cognitive effectiveness, with less attention to affective aspects such as attitudes, motivation, and sociocultural dimensions that are also important in language learning. Seventh, the rapid development of technology means some findings from older articles may have become less relevant, although researchers have tried to focus on publications from the last decade to minimize this issue.

E. CONCLUSIONS

Based on this systematic literature review, it can be concluded that digital technology offers significant potential in enhancing the effectiveness of Arabic language learning across the four skills, although the level of effectiveness varies depending on the type of technology, target language skills, and implementation context. In addressing the first research objective regarding the identification and classification of technology types, six main categories have been identified including mobile learning applications, e-learning platforms, gamification technology, speech recognition and pronunciation technology, virtual and augmented reality, and computer-assisted writing tools, with mobile applications and e-learning platforms being the most widely researched and applied. For the second objective regarding effectiveness analysis, findings show that technology demonstrates highest effectiveness for listening skills with average improvement of 42%, followed by reading skills 45%, speaking skills 38%, and writing skills 33%, indicating that technology is more effective for supporting receptive skills compared to productive skills that require more complex interactional dimensions. Meanwhile, in addressing the third objective regarding best practice recommendations, this research formulates that effective technology integration requires five critical elements, namely high teacher digital literacy, solid instructional design based on clear pedagogical frameworks, adequate technology infrastructure and student access, positive sociocultural context and student attitudes, and balanced duration and intensity

of use, with technology most effectively functioning as a complement to rather than replacement for human instruction.

Several recommendations emerge from this research for various stakeholders. For Arabic language educators, it is recommended to begin technology integration by identifying specific learning objectives for each maharah, then selecting appropriate types of technology that align with those objectives and available contexts, followed by designing integrated instructional activities that combine technology use with teacher guidance and peer interaction. Educators are also advised to continuously develop their digital literacy competencies through professional development programs focused on TPACK. For educational institutions, it is recommended to invest not only in technological infrastructure but also in systematic teacher training programs, develop clear policies regarding technology integration that support rather than burden teachers, and create a supportive environment that encourages innovation and experimentation in technology use for learning. For curriculum developers and policymakers, recommendations include integrating digital literacy and technology-based Arabic learning into teacher education curricula, developing quality standards for Arabic learning technology that are contextually appropriate, providing incentives for technology development and research specific to Arabic learning needs, and building partnerships between educational institutions, technology industry, and research institutions to accelerate innovation. For future researchers, it is recommended to conduct more longitudinal studies to examine long-term effects of technology use, develop research with stronger experimental designs and larger samples to test causality, explore more innovative emerging technologies such as VR/AR and more advanced AI, conduct more research in diverse contexts including Southeast Asia to test generalizability of findings, and pay more attention to affective and sociocultural aspects that are often overlooked in existing technology effectiveness research.

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