

Augmented Reality and Virtual Reality in Arabic Speaking Skills Instruction: A Systematic Review of Pedagogical Contributions

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Abstract

Advances in Augmented Reality (AR) and Virtual Reality (VR) have opened innovative opportunities in Arabic language learning, particularly in Arabic speaking skills (mahārat al-kalām). However, previous research remains fragmented, examining AR and VR separately without providing a comprehensive picture of their integration's impact. This study analyzes the role of AR and VR in enhancing Arabic speaking skills through a Systematic Literature Review using the PRISMA framework on 12 Scopus-indexed articles (2020–2025). The findings indicate that the integration of AR and VR significantly enhances communicative interaction and learning engagement. According to the reviewed studies, AR is effective in helping students enrich vocabulary and contextual understanding through visualization, while VR demonstrates greater effectiveness in improving speaking fluency, pronunciation accuracy, and self-confidence through immersive simulations. The combination creates a more holistic learning experience by integrating visual, auditory, and social interaction elements. However, implementation effectiveness is influenced by teacher readiness, technological infrastructure, and cost. This study identifies that AR and VR

serve complementary pedagogical functions, with AR supporting vocabulary acquisition and VR enabling communicative practice. It emphasizes that effective implementation requires systematic alignment of instructional design, teacher professional development, and institutional infrastructure.

Abstrak

Perkembangan Augmented Reality (AR) dan Virtual Reality (VR) membuka peluang inovatif dalam pembelajaran bahasa Arab, khususnya *mahārat al-kalām* (keterampilan berbicara). Namun, penelitian sebelumnya masih terfragmentasi, mengkaji AR dan VR secara terpisah tanpa memberikan gambaran komprehensif tentang dampak integrasinya. Penelitian ini menganalisis peran AR dan VR dalam meningkatkan *mahārat al-kalām* melalui Systematic Literature Review menggunakan kerangka PRISMA terhadap 12 artikel terindeks Scopus (2020–2025). Hasil menunjukkan bahwa integrasi AR dan VR secara signifikan meningkatkan interaksi komunikatif dan keterlibatan belajar. Menurut studi yang dianalisis, AR efektif membantu siswa memperkaya kosakata dan pemahaman kontekstual melalui visualisasi, sedangkan VR menunjukkan efektivitas lebih besar dalam meningkatkan kelancaran berbicara, ketepatan pengucapan, dan kepercayaan diri melalui simulasi imersif. Kombinasi keduanya menghasilkan pengalaman belajar lebih holistik dengan mengintegrasikan interaksi visual, auditori, dan sosial. Namun, efektivitas implementasi dipengaruhi kesiapan guru, infrastruktur teknologi, dan biaya. Penelitian ini mengidentifikasi bahwa AR dan VR memiliki fungsi komplementer, dengan AR mendukung pengenalan kosakata dan VR memungkinkan praktik komunikatif. Penelitian ini menekankan bahwa implementasi efektif memerlukan keselarasan sistematis antara desain pembelajaran, pengembangan profesional guru, dan infrastruktur institusional.

المخلص

أتاحت التطورات في تقنيات الواقع المعزز والواقع الافتراضي فرصاً مبتكرة في تعليم اللغة العربية، لا سيما في مجال مهارة الكلام. غير أن الأبحاث السابقة تتسم بالثبوت، حيث تركز على هاتين التقنيتين بشكل منفصل دون تقديم صورة شاملة عن أثر دمجهما. تسعى هذه الدراسة إلى تحليل دور الواقع المعزز والواقع الافتراضي في تحسين مهارة الكلام من خلال مراجعة منهجية للأدبيات باستخدام إطار بريزما على اثني عشرة مقالة مفرسة في سكوبس خلال الفترة ٢٠٢٠-٢٠٢٥. تشير النتائج إلى أن دمج الواقع المعزز والواقع الافتراضي يعزز التفاعل التواصلي والانخراط في التعلم بشكل كبير. وبحسب الدراسات المراجعة، يثبت الواقع المعزز فعاليته في مساعدة الطلاب على إثراء الحصيلة اللغوية والفهم السياقي من خلال التصور البصري، بينما يظهر الواقع الافتراضي فعالية أكبر في تحسينطلاقة الكلام ودقة النطق والثقة بالنفس عبر محاكاة غامرة. تحدد هذه الدراسة أن الواقع المعزز والواقع الافتراضي يؤديان وظائف تربية متكاملة، حيث يدعم الأول اكتساب المفردات ويمكّن الثاني من الممارسة التواصلية. وتؤكد الدراسة أن التطبيق الفعال يتطلب توافقاً منهجياً بين تصميم التعليم والتطوير المهني للمعلم والبنية التحتية المؤسسية.

Keywords: Arabic language; augmented reality; speaking skills; systematic literature review; virtual reality

Introduction

Arabic speaking skills, or *mahārat al-kalām* are an essential component of language proficiency. This ability serves not only as a means of communication but also as a comprehensive indicator of deep understanding and mastery of the language.¹ Given the significance of these skills, the

¹ Yazid Hady, "Pembelajaran Mahārat Al-Kalām Menurut Rusdy Ahmad Thu'aimah Dan Mahmud Kamil Al-Nāqah," *Al Mahāra Jurnal Pendidikan Bahasa Arab* 5, No. 1 (2019): 63-84, <https://doi.org/10.14421/almaara.2019.051-04>; Muspika Hendri, "Pembelajaran Keterampilan Berbicara Bahasa Arab Melalui Pendekatan

development of effective teaching methodologies and approaches is imperative. The primary objective of *mahārat al-kalām* instruction is to enhance students' communication and interaction capabilities in Arabic.² However, inherent challenges such as limited vocabulary and a lack of opportunities for direct speaking practice often pose substantial obstacles to improving these skills.³

These challenges demand a learning approach that is not only focused on content delivery but also capable of providing contextual, interactive, and repetitive practice opportunities for students. In this context, the development of digital technologies such as Augmented Reality (AR) and Virtual Reality (VR) becomes relevant as an alternative pedagogical solution. These technologies offer immersive and communicative learning environments, thereby potentially bridging the gap in speaking practice and enriching *mahārat al-kalām* experiences in a more authentic and practical manner.⁴ Recent trends in Arabic language learning media development in the Era 5.0 context emphasize the importance of integrating advanced digital technologies to enhance

Komunkatif," *Potensia Jurnal Kependidikan Islam* 3, No. 2 (2017): 196, <https://doi.org/10.24014/potensia.v3i2.3929>.

² Khoirul Bariyah and Muassomah Muassomah, "Metode Ta'bir Ash-Shuwar Al-'Asywai: Inovasi Pembelajaran Maharah Kalam Mahasiswa Pendidikan Bahasa Arab IAIN Madura," *Alfazuna: Jurnal Pembelajaran Bahasa Arab dan Kebahasaaraban* 4, no. 1 (2019): 1-34, <https://doi.org/10.15642/alfazuna.v4i1.509>.

³ Abdal Chaqil Harimi, "Pembelajaran Maharah Bahasa Arab Berbasis Inklusif," *Tarling : Journal of Language Education* 1, no. 2 (2018): 19-32, <https://doi.org/10.24090/tarling.v1i2.1783>; Isnaini Lubis et al., "Students' Difficulties in Practicing Arabic's Maharah Kalam at the Arabic Language Education Department IAIN Langsa," *El-Tsaqafah : Jurnal Jurusan PBA* 21, no. 1 (2022): 1-14, <https://doi.org/10.20414/tsaqafah.v21i1.4690>.

⁴ Mohammad Fadil Akbar Islamy et al., "Strategi Mengatasi Problematikan Teknologi dalam Pembelajaran Bahasa Arab di Abad 21," *COMSERVA : Jurnal Penelitian dan Pengabdian Masyarakat* 4, no. 3 (2024): 723-30, <https://doi.org/10.59141/comserva.v4i3.1365>.

pedagogical quality and student engagement.⁵ The implementation of these technologies not only transforms instructional processes but also substantially enhances student motivation and learning experiences.⁶ AR and VR have the potential to create engaging learning environments where students not only acquire theoretical knowledge but can also interact within more realistic and practical contexts.⁷

Specifically, AR, which integrates digital elements with physical reality, can enhance interaction in *mahārat al-kalām* instruction. For example, AR applications that visualize three-dimensional objects relevant to language content can facilitate students' contextual understanding of communication more effectively.⁸ This technology allows students to overcome physical limitations in interaction, as they can interact directly

⁵ Anisa Alfurochmatin and Ahmad Muhaimin Bin Mat Jusoh, "Tren Pengembangan Media Pembelajaran Bahasa Arab di Indonesia Era 5.0," *Alsina: Journal of Arabic Studies* 6, no. 1 (2024): 1-26, <https://doi.org/10.21580/alsina.6.1.21278>.

⁶ Ade Muhammad Ritonga et al., "Tantangan dan Hambatan : Analisis Problematika Pembelajaran Bahasa Arab Era Society 5.0 di Perguruan Tinggi Agama Islam di Indonesia," *Syntax Literate ; Jurnal Ilmiah Indonesia* 8, no. 5 (2023): 3272-80, <https://doi.org/10.36418/syntax-literate.v8i5.11540>; Salman Alfarisi and Ari Septiawati, "Suitability of Maharah Kalam Learning Achievement in JSIT Arabic Learning Curriculum With CEFR," *Al-Hikmah: Jurnal Agama Dan Ilmu Pengetahuan* 19, no. 2 (2023): 231-55, [https://doi.org/10.25299/al-hikmah:jaip.2022.vol19\(2\).9543](https://doi.org/10.25299/al-hikmah:jaip.2022.vol19(2).9543).

⁷ Mualim Wijaya and Faiqotul Hikmah, "Problematika Pembelajaran Maharah Qiro'ah dalam Pembelajaran Bahasa Arab pada Siswa Madrasah Ibtidaiyah," *Jurnal Educatio FKIP UNMA* 9, no. 2 (2023): 858-64, <https://doi.org/10.31949/educatio.v9i2.4880>.

⁸ Isabel Schorr et al., "Foreign Language Learning Using Augmented Reality Environments: A Systematic Review," *Frontiers in Virtual Reality* 5 (2024): 1-15, <https://doi.org/10.3389/frvir.2024.1288824>; Ferdi Çelik and Ceylan Yangin Ersanlı, "The Use of Augmented Reality in a Gamified CLIL Lesson and Students' Achievements and Attitudes: A Quasi-Experimental Study," *Smart Learning Environments* 9 (2022): 30, <https://doi.org/10.1186/s40561-022-00211-z>.

with projected virtual objects.⁹ Unlike AR, which enriches physical reality with digital elements and strengthens contextual interaction in real-world environments, VR provides a fully immersive experience by virtually simulating new environments.

Meanwhile, VR offers a more in-depth experience through simulations of real-world environments, allowing students to practice speaking Arabic with virtual characters in various conversational scenarios.¹⁰ Through repeated practice in a safe and controlled environment, students can improve their fluency and build confidence in communicating without the social pressure often present in conventional classrooms.¹¹ The simulated conversational scenarios are designed to be relevant to actual situations students might encounter in daily life, thereby enhancing the relevance and applicability of learning.¹²

Although the potential for implementing AR and VR is immense, challenges remain. Several studies indicate that hardware and software limitations often pose technical barriers to the implementation of these technologies in

⁹ Çelik and Yangın Ersanlı, "The Use of Augmented Reality in a Gamified CLIL Lesson and Students' Achievements and Attitudes: A Quasi-Experimental Study."

¹⁰ Regina Kaplan-Rakowski and Alice Gruber, "The Impact of High-Immersion Virtual Reality on Foreign Language Anxiety," *Smart Learning Environments* 10 (2023): 46, <https://doi.org/10.1186/s40561-023-00263-9>.

¹¹ A. Rahman et al., "The Use of Virtual Reality Platforms to Improve Students' Speaking Skills," in *Proceedings of the 2024 6th International Conference on Image Processing and Machine Vision* (New York: Association for Computing Machinery, 2024), 100–106, <https://doi.org/10.1145/3645259.3645276>.

¹² Raffaele Di Fuccio et al., "Co-Created Augmented Reality App and Its Impact on the Effectiveness of Learning a Foreign Language and on Cultural Knowledge," *Smart Learning Environments* 11 (2024): 21, <https://doi.org/10.1186/s40561-024-00304-x>.

educational institutions.¹³ Additionally, issues of cost and accessibility also influence the adoption of these technologies by students and teachers.¹⁴ Therefore, the urgency of developing AR- and VR-based learning content tailored to the Arabic language curriculum is highly relevant.¹⁵

While numerous studies have explored the potential of AR and VR in language education generally, empirical research specifically investigating the direct and comprehensive impact of integrating these two technologies on enhancing *mahārat al-kalām* within the context of Arabic language learning in Indonesia remains limited. Most studies tend to focus on one technology (AR or VR) separately, or on other aspects of language skills, rather than on the synergy of both for speaking skills. This creates a significant research gap, particularly in understanding the combined effectiveness of AR and VR in addressing specific barriers faced by Arabic language learners in Indonesia, such as the lack of an immersive environment for conversation practice.

The research gap identified in the preceding section underscores the urgent need for a study that systematically

¹³ Haozhe Jiang et al., "Virtual Reality and Augmented Reality-Supported K-12 STEM Learning: Trends, Advantages and Challenges," *Education and Information Technologies* 30, no. 9 (2025): 12827–63, <https://doi.org/10.1007/s10639-024-13210-z>.

¹⁴ Sathya Thangavel et al., "Revolutionizing Education Through Augmented Reality (AR) and Virtual Reality (VR): Innovations, Challenges and Future Prospects," *Asian Journal of Interdisciplinary Research* 8, no. 1 (2025): 1–28, <https://doi.org/10.54392/ajir2511>.

¹⁵ Lily Hanefarezan Asbulah et al., "Teachers' Attitudes Towards the Use of Augmented Reality Technology in Teaching Arabic in Primary School Malaysia," *International Journal of Advanced Computer Science and Applications* 13, no. 10 (2022): 465–74, <https://doi.org/10.14569/IJACSA.2022.0131055>; Mohd Akashah Mohamad Yusof et al., "The Readiness of KAFA Arabic Teachers Towards Utilizing Augmented Reality in Teaching Arabic Vocabularies," in *Artificial Intelligence (AI) and Customer Social Responsibility (CSR)*, ed. Reem Khamis Hamdan and Amina Buallay, vol. 517 (Cham: Springer, 2024), 815–21, https://doi.org/10.1007/978-3-031-50939-1_65.

integrates the available empirical evidence on AR and VR within a single, comprehensive analytical framework. This study addresses that need by employing a Systematic Literature Review (SLR) approach, selected for its capacity to identify, evaluate, and synthesize empirical literature in a manner that is transparent, valid, and replicable. To ensure these reporting standards are upheld, this study adheres to the PRISMA (*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*) protocol, adopting the model established by Page et al.¹⁶ This protocol ensures that each stage of the selection process is clearly documented, thereby minimizing bias and guaranteeing that the articles analyzed meet rigorous methodological quality standards.

Stage 1: Formulation of Research Questions

To guide the literature search and analysis in a focused and systematic manner, this study establishes three primary research questions, each derived from the empirical gaps identified in the introduction. (RQ1) How does the integration of AR and VR impact the development of *mahārat al-kalām* in Arabic language learning? This question aims to map empirical evidence regarding the tangible contributions of both technologies, whether applied separately or in combination, to communicative interaction, learning engagement, and the development of students' speaking competence. (RQ2) How effective are AR and VR in supporting the measurable indicators of speaking skills, such as fluency, pronunciation accuracy, vocabulary mastery, and communicative confidence? This question aims to identify the effectiveness patterns of each technology more specifically, including the conditions under which AR or VR demonstrates a more significant comparative advantage over conventional approaches. (RQ3)

¹⁶ Matthew J Page et al., "The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews," *BMJ*, 2021, 1-9, <https://doi.org/10.1136/bmj.n71>.

What are the primary challenges and obstacles encountered in implementing AR and VR for *mahārat al-kalām* instruction? This question aims to analyze inhibiting factors of a technological, pedagogical, psychological, and economic nature that demonstrably limit the optimal potential of AR and VR in real educational settings, thereby providing a basis for practical recommendations for educators and policymakers.

Stage 2: Literature Search and Selection Strategy

The literature search was conducted exclusively within the Scopus electronic database, selected for its internationally recognized reputation as a guarantor of peer-reviewed quality. To ensure the currency of the technologies examined, the search was restricted to articles published within the last five years (2020–2025). This temporal restriction is methodologically grounded in the argument that immersive technologies including AR and VR have undergone a significant leap in innovation, in both hardware and software, in the post-COVID-19 era. Consequently, literature from this period most accurately represents the current state of technology and pedagogy as it pertains to contemporary language education.

The search strategy was developed by constructing a search string that combines primary keywords using Boolean operators (AND, OR). To ensure the precision of the data retrieval without casting the net too broadly, the search was focused exclusively on the TITLE-ABS-KEY query field in Scopus. The keyword formulation used was as follows: TITLE-ABS-KEY ("Augmented Reality" OR "Virtual Reality" OR "AR" OR "VR") AND ("Arabic" OR "Arabic language") AND ("Speaking" OR "Speaking skill" OR "maharah kalam" OR "Communication").

To guarantee the validity and relevance of the analyzed data, this study applies a tiered selection process based on a rigorous set of inclusion and exclusion criteria. The primary focus of the selection is to identify articles that present

empirical evidence regarding the implementation of AR or VR specifically within the context of language learning. The detailed eligibility parameters are presented in Table 1.

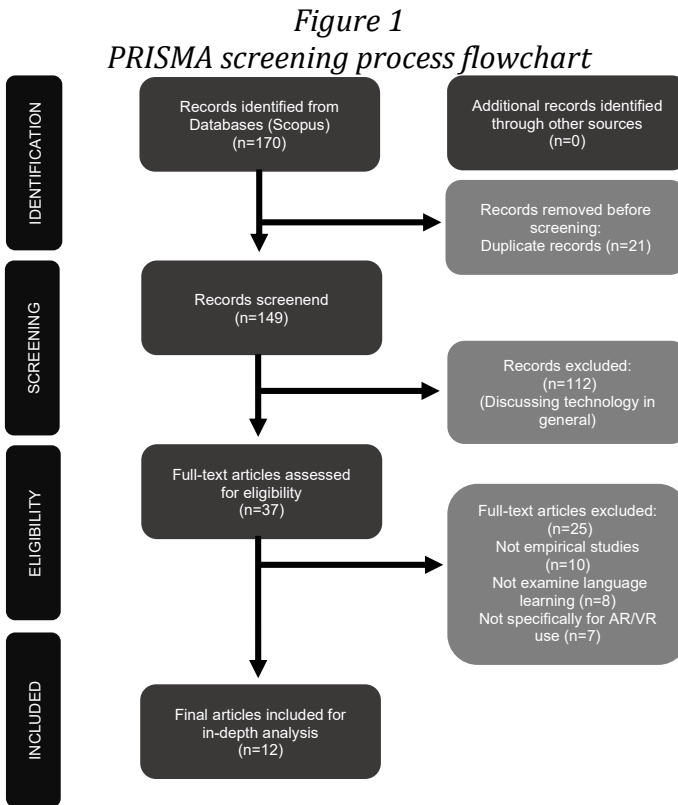
Table 1
Inclusion and exclusion criteria

Parameter	Inclusion Criteria	Exclusion Criteria
Publication Type	Peer-reviewed journal articles and international conference proceedings presenting empirical research data.	Book chapters, dissertations/theses, literature review articles, and opinion pieces.
Database Reputation	Officially indexed in an internationally reputable database (Scopus) to ensure peer-review quality.	Publications not indexed in Scopus, predatory journals, or those lacking a valid Digital Object Identifier (DOI).
Time Frame	Published within the last five years (2020–2025) to ensure currency of AR/VR technological innovation.	Articles published before 2020.
Subject & Research Focus	Explicitly examines the effectiveness, impact, or implementation challenges of AR and VR in facilitating language learning.	General technology studies, articles not addressing language learning media, and studies focusing on conventional media.

Stage 3: Article Selection Process (PRISMA)

Following the application of the baseline criteria, the collected articles entered a four-stage selection process guided by the PRISMA flow diagram, culminating in the determination of the final article corpus. (1) *Identification*: An initial database search yielded 170 articles. After checking for duplicates and incomplete metadata, 21 articles were removed. (2) *Screening*: The remaining 149 articles were screened for eligibility based on title and abstract relevance; 112 articles were excluded because their content only addressed the use of digital technology outside the context of education. (3) *Eligibility*

Assessment: The 37 articles that passed the screening stage were retrieved in full text for a quality appraisal; 25 articles were subsequently excluded as they were not empirical studies, did not examine language learning, and did not specifically address the use of AR/VR. **(4) Inclusion:** Based on this assessment, 12 final articles were determined to meet all inclusion and methodological quality standards. This whole process is illustrated in Figure 1.



Stage 4: Data Extraction and Synthesis

Data from the 12 selected articles were systematically extracted into a structured extraction matrix encompassing several key elements: year of publication, author names, article title, the technology examined (AR, VR, or both), educational context and level, research methodology employed, *mahārat*

al-kalām indicators measured, principal findings related to learning effectiveness and impact, and implementation challenges reported. The use of this extraction matrix was designed to ensure the consistency and completeness of the data collected from each article, while simultaneously facilitating cross-study comparisons.

Data synthesis was conducted through a two-level thematic analysis adapted from the thematic synthesis approach of Miles and Huberman. At the first level, *open coding* was performed, whereby the content of each article, encompassing the background, findings, discussion, and conclusion, was read carefully line by line to identify and label segments of text that were directly relevant to the research questions. This process generated a range of initial codes, such as "vocabulary enhancement through AR," "VR conversation simulation," "speaking anxiety," and "infrastructure constraints," among others.

At the second level, *thematic coding*, or axial coding, was conducted, whereby initial codes sharing conceptual similarities or relational connections were grouped and organized into higher-order categories. This grouping process yielded three overarching themes that directly address each respective RQ: (1) the impact of AR and VR integration on *mahārat al-kalām*, encompassing sub-themes of enhanced communicative interaction, learning engagement, and immersive experience; (2) the comparative effectiveness of AR and VR across speaking skill indicators, containing sub-themes of AR's advantage in vocabulary enrichment and contextual visualization, and VR's advantage in fluency simulation and confidence-building; and (3) the challenges of AR and VR implementation, encompassing sub-themes of technological barriers, teachers' pedagogical readiness, student engagement and adaptation, and economic and accessibility constraints.

To ensure the credibility and consistency of the coding process, all stages of analysis were conducted by a single lead researcher. To establish intra-rater reliability, a portion of the articles was re-analyzed after a period of time and the results were compared against the initial coding. Furthermore, the synthesis process was conducted iteratively, with constant reference back to the research questions and source literature whenever a new theme emerged, ensuring that the resulting interpretations remained anchored in empirical data and did not deviate from the established aims of the study.

Result

The Impact of AR and VR Technology Integration on Mahārat al-Kalām

Based on an analysis of 12 selected articles, it was found that the integration of Augmented Reality (AR) and Virtual Reality (VR) technologies makes a significant contribution to the development of *mahārat al-kalām* in language learning. Regarding Augmented Reality (AR), several studies report that the use of AR-based media contributes to improved vocabulary mastery and student verbal participation through the contextual visualization of objects in real-world environments.¹⁷ Additionally, AR allows students to interact with three-dimensional representations that support a more concrete understanding of meaning in the language communication process.¹⁸ Other studies also indicate that the use of AR in language learning can increase student

¹⁷ Prasetyo Yuli Kurniawan et al., "Revolutionizing Language Learning: Exploring the Efficacy of Augmented Reality Technology Through Assemblr Studio," in *E3S Web of Conferences*, ed. M. Setiyo et al., vol. 500, 2024, 01020, <https://doi.org/10.1051/e3sconf/202450001020>.

¹⁸ Çelik and Yangın Ersanlı, "The Use of Augmented Reality in a Gamified CLIL Lesson and Students' Achievements and Attitudes: A Quasi-Experimental Study."

engagement in learning activities and encourage active participation in speaking practice.¹⁹

Meanwhile, regarding Virtual Reality (VR), the analysis results indicate that this technology is more effective in improving speaking fluency, pronunciation accuracy, and students' confidence in communication.²⁰ The immersive environment provided by VR allows students to practice in conversation simulations that resemble real-life situations, thereby offering more intensive and repetitive practice opportunities.²¹ Additionally, VR is reported to enhance social engagement in language learning through interactions with virtual characters or simulated environments.²²

The integration of AR and VR within metaverse-based learning platforms demonstrates a more comprehensive impact on language skill development. The combination of these two technologies allows students to gain a more holistic learning experience, encompassing visual, auditory, and social interactions within a single integrated environment.²³ These findings indicate that the integration of AR and VR impacts not only a single aspect of speaking skills but also simultaneously strengthens various indicators of *mahārat al-kalām*.

¹⁹ Asbulah et al., "Teachers' Attitudes Towards the Use of Augmented Reality Technology in Teaching Arabic in Primary School Malaysia."

²⁰ Rahman et al., "The Use of Virtual Reality Platforms to Improve Students' Speaking Skills."

²¹ Di Fuccio et al., "Co-Created Augmented Reality App and Its Impact on the Effectiveness of Learning a Foreign Language and on Cultural Knowledge."

²² Napoleon Prabakaran et al., "Enhancing English Language Proficiency and Digital Literacy Through Metaverse-Based Learning: A Mixed-Methods Study in Higher Education," *Journal of Information Technology Education: Research* 24, no. 10 (2025): 1-25, <https://doi.org/10.28945/5484>.

²³ Prabakaran et al.

The Use of AR and VR in Teaching Mahārat al-Kalām

The use of AR and VR in *mahārat al-kalām* instruction in this study was assessed through speaking skill indicators, including fluency, pronunciation accuracy, vocabulary mastery, and confidence in communication. Based on a synthesis of the analyzed articles, it was found that AR and VR technologies demonstrate varying levels of effectiveness across different skill dimensions.

The use of AR is reported to be effective in improving vocabulary mastery and supporting language concept understanding through contextual visual presentations.²⁴ Additionally, AR plays a role in increasing student participation in learning activities by providing engaging and easily accessible interactive media.²⁵ Several studies also indicate that the use of AR can increase students' interest in learning and their engagement in the language learning process.²⁶

On the other hand, VR demonstrates greater effectiveness in improving the performative aspects of speaking skills, such as fluency and students' self-confidence.²⁷ The simulated environments provided by VR allow students to practice in realistic conversational contexts without the social pressure typically present in conventional classrooms.²⁸ Additionally, VR offers context-based learning experiences rooted in social and cultural contexts that support a more authentic

²⁴ Kurniawan et al., "Revolutionizing Language Learning: Exploring the Efficacy of Augmented Reality Technology Through Assemblr Studio."

²⁵ Çelik and Yangın Ersanlı, "The Use of Augmented Reality in a Gamified CLIL Lesson and Students' Achievements and Attitudes: A Quasi-Experimental Study."

²⁶ Asbulah et al., "Teachers' Attitudes Towards the Use of Augmented Reality Technology in Teaching Arabic in Primary School Malaysia."

²⁷ Rahman et al., "The Use of Virtual Reality Platforms to Improve Students' Speaking Skills."

²⁸ Di Fuccio et al., "Co-Created Augmented Reality App and Its Impact on the Effectiveness of Learning a Foreign Language and on Cultural Knowledge."

understanding of language use.²⁹ Thus, a comparison of findings across studies indicates that AR and VR possess distinct utility characteristics, where AR focuses more on content enrichment and contextual interaction, while VR focuses more on communication simulation and the practical development of speaking skills.³⁰ Consequently, the utility of these two technologies is complementary in supporting the development of *mahārat al-kalām*. Recent research on best practices in teaching speaking skills emphasizes that effective instruction must consider multiple dimensions including communicative interaction, learning engagement, and student confidence-building.³¹ In this context, AR and VR serve distinct but complementary pedagogical functions. AR's strength in vocabulary acquisition and concept understanding aligns with the principle of contextual scaffolding, while VR's superiority in improving fluency and self-confidence reflects the effectiveness of immersive, low-anxiety practice environments that enable learners to develop communication competencies without the social pressure of conventional classroom settings.

Challenges and Obstacles in the Implementation of AR and VR in Mahārat al-Kalām

In addition to highlighting various positive impacts, the analysis also identified a number of challenges and barriers to the implementation of AR and VR technologies in language learning. These challenges can be classified into several key

²⁹ Prabakaran, Patrick, And Kareem, "Enhancing English Language Proficiency And Digital Literacy Through Metaverse-Based Learning: A Mixed-Methods Study In Higher Education."

³⁰ Mohmmad Khasawneh, "Analyzing the Strategic Effects of AI-Powered Virtual and Augmented Reality Systems in English Language Education at the Tertiary Level," *Research Journal in Advanced Humanities* 5, no. 3 (2024): 188–202, <https://doi.org/10.58256/j74yfg59>.

³¹ Fuad Munajat and M Imam Zaenal Abidin, "Best Practices for Teaching Speaking Skills Based on Management Aspects and ACTFL Proficiency Levels at STIBA Ar Raayah," *Alsina : Journal of Arabic Studies* 7, no. 2 (2025): 257–84, <https://doi.org/10.21580/alsina.7.2.28197>.

aspects: technological, pedagogical, user-related, and economic. Regarding the technological aspect, limitations in hardware and infrastructure are among the primary barriers to the adoption of AR and VR. Several studies report that not all educational institutions have access to adequate devices to support the optimal use of immersive technologies.³² Additionally, the need for a stable internet connection is also a factor influencing the success of implementing these technologies in learning.³³

From a pedagogical perspective, teachers' readiness to integrate AR and VR technologies into the learning process remains a significant challenge. Several studies indicate that limited technological competence and a lack of training are factors hindering the optimal utilization of these technologies.³⁴ Furthermore, a lack of understanding in designing technology-based learning scenarios also poses a challenge in classroom implementation.³⁵

From the user perspective, student engagement with AR and VR technologies varies significantly. Some studies report that not all students have the same level of comfort using new technologies, which can affect learning effectiveness.³⁶

³² Jiang et al., "Virtual Reality and Augmented Reality-Supported K-12 STEM Learning: Trends, Advantages and Challenges."

³³ Thangavel et al., "Revolutionizing Education Through Augmented Reality (AR) and Virtual Reality (VR): Innovations, Challenges and Future Prospects."

³⁴ Asbulah et al., "Teachers' Attitudes Towards the Use of Augmented Reality Technology in Teaching Arabic in Primary School Malaysia."

³⁵ Yusof et al., "The Readiness of Kafa Arabic Teachers Towards Utilizing Augmented Reality in Teaching Arabic Vocabularies."

³⁶ Amirasoud Momenipour et al., "Board 127: Work in Progress: Strategizing the Integration of VR and AR in STEM Education: Aligning Educational, Organizational, and Technological Strategies," in *ASEE Annual Conference and Exposition, Conference Proceedings* (Portland: American Society for Engineering Education, 2024), <https://nemo.asee.org/public/conferences/344/papers/44150/view>.

Furthermore, adapting to virtual environments poses a unique challenge for some students in the language learning process.

From an economic perspective, the cost of implementing AR and VR technologies is one of the main barriers to their widespread adoption. The high costs of devices and the development of AR- and VR-based learning content pose a challenge for educational institutions with limited resources.³⁷ This situation creates an access gap to learning technologies between institutions with adequate resources and those without. Overall, the analysis results indicate that although AR and VR hold great potential for enhancing the quality of *mahārat al-kalām* learning, their implementation is still influenced by various supporting factors that require systematic consideration.

Discussion

The Impact of AR and VR Technology Integration on Mahārat al-Kalām

The research findings indicate that the integration of Augmented Reality (AR) and Virtual Reality (VR) significantly contributes to the improvement of *mahārat al-kalām* skills. Conceptually, these findings can be explained through the framework of immersive learning, in which learning experiences involving visual, auditory, and kinesthetic interactions can deepen language comprehension. AR- and VR-based learning environments allow students to engage in experiences that resemble real-life situations, thereby strengthening the connection between language and its contextual use.³⁸

³⁷ Thangavel et al., "Revolutionizing Education Through Augmented Reality (AR) and Virtual Reality (VR): Innovations, Challenges and Future Prospects."

³⁸ Maria Ibanez et al., "Learning a Foreign Language in a Mixed-Reality Environment," *IEEE Internet Computing* 15, no. 6 (2011): 44-47, <https://doi.org/10.1109/MIC.2011.78>.

From a pedagogical perspective, AR plays a role in enriching linguistic input through contextual visualization that helps students understand the meaning of vocabulary more concretely. This aligns with findings that the use of three-dimensional objects in AR can increase cognitive engagement and facilitate the process of meaning construction in language learning.³⁹ AR also contributes to enhancing learning motivation through the presentation of more engaging and interactive materials, thereby encouraging students' verbal participation in the communication process.⁴⁰

Meanwhile, VR demonstrates a stronger impact on the performative aspects of *mahārat al-kalām*, particularly in improving students' speaking fluency and self-confidence. This can be explained through the concept of situated learning, where learning that occurs in a realistic simulated environment allows students to practice language in authentic social contexts.⁴¹ VR also provides a practice space free from social pressure, enabling students to practice speaking more intensively without fear of making mistakes.⁴²

Several studies have shown that the use of VR involving virtual social interaction can comprehensively improve students' communication competencies. This aligns with findings that VR environments can enhance communication skills and linguistic competencies through immersive and

³⁹ Kurniawan et al., "Revolutionizing Language Learning: Exploring the Efficacy of Augmented Reality Technology Through Assemblr Studio."

⁴⁰ Shin-Jia Ho et al., "Applying Game-Based Experiential Learning to Comprehensive Sustainable Development-Based Education," *Sustainability* 14, no. 3 (2022): 1172, <https://doi.org/10.3390/su14031172>; Çelik and Yangın Ersanlı, "The Use of Augmented Reality in a Gamified CLIL Lesson and Students' Achievements and Attitudes: A Quasi-Experimental Study."

⁴¹ Di Fuccio et al., "Co-Created Augmented Reality App and Its Impact on the Effectiveness of Learning a Foreign Language and on Cultural Knowledge."

⁴² Ho et al., "Applying Game-Based Experiential Learning to Comprehensive Sustainable Development-Based Education."

contextual learning experiences.⁴³ Moreover, from a cognitive perspective, learning experiences in virtual environments can also enhance the ecological validity of language learning, as students interact in situations that resemble real-world conditions.⁴⁴

Thus, the integration of AR and VR impacts not only the cognitive aspects but also the affective and social aspects of *mahārat al-kalām* learning. The combination of these two technologies enables the creation of a more holistic learning experience, where students not only understand the language theoretically but are also able to use it practically in authentic communication contexts.⁴⁵

The Use of AR and VR in Teaching Mahārat al-Kalām

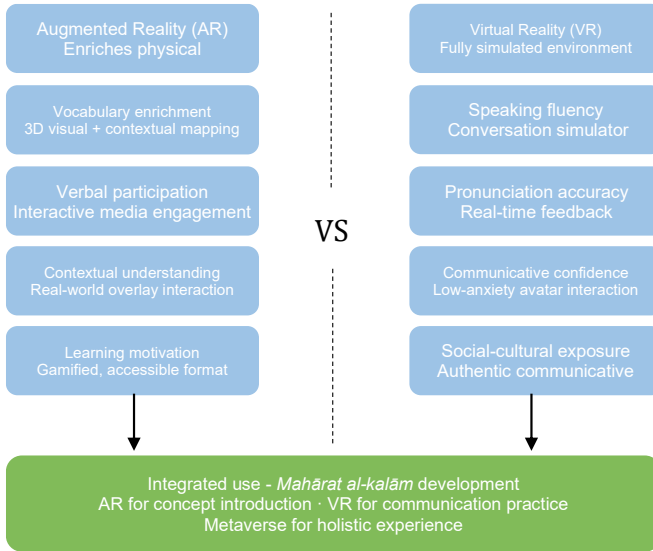
The effectiveness patterns identified in the Results section, AR excelling in vocabulary mastery and contextual understanding, VR excelling in fluency and confidence, warrant a theoretical interpretation that moves beyond surface-level description.

⁴³ Alex Barrett et al., "Technology Acceptance Model and Multi-User Virtual Reality Learning Environments for Chinese Language Education," *Interactive Learning Environments* 31, no. 3 (2023): 1665–82, <https://doi.org/10.1080/10494820.2020.1855209>.

⁴⁴ David Peeters, "Bilingual Switching between Languages and Listeners: Insights from Immersive Virtual Reality," *Cognition* 195 (2020): 104107, <https://doi.org/10.1016/j.cognition.2019.104107>.

⁴⁵ Yueqi Weng et al., "The Effectiveness of Immersive Learning Technologies in K–12 English as Second Language Learning: A Systematic Review," *ReCALL* 36, no. 2 (2024): 210–29, <https://doi.org/10.1017/S0958344024000041>; Prabakaran et al., "Enhancing English Language Proficiency and Digital Literacy Through Metaverse-Based Learning: A Mixed-Methods Study in Higher Education."

Figure 2
The complementary roles of AR and VR in
mahārat al-kalām development



As illustrated in Figure 2, these two technologies occupy distinct but complementary positions within the instructional cycle of *mahārat al-kalām* development, and their differential effectiveness can be traced to fundamentally different cognitive mechanisms.

AR's advantage in vocabulary acquisition and concept understanding is theoretically explained by its capacity for *contextual scaffolding* through real-world overlay.⁴⁶ When learners interact with AR-rendered three-dimensional objects in their immediate physical environment, the technology exploits the brain's natural tendency toward associative encoding by linking new linguistic forms to perceptually rich, spatially grounded representations.⁴⁷ This mechanism is

⁴⁶ Çelik and Yangın Ersanlı, "The Use of Augmented Reality in a Gamified CLIL Lesson and Students' Achievements and Attitudes: A Quasi-Experimental Study."

⁴⁷ Kurniawan et al., "Revolutionizing Language Learning: Exploring the Efficacy of Augmented Reality Technology Through Assemblr Studio."

consistent with dual-coding theory, which predicts that information encoded through both verbal and non-verbal channels is retained more durably than information processed through a single modality.⁴⁸ The gamified, accessible format of AR further sustains this process by maintaining motivational engagement across repeated exposures,⁴⁹ a condition that vocabulary consolidation research consistently identifies as necessary for long-term retention.⁵⁰

VR's superior effectiveness in improving speaking fluency and self-confidence, on the other hand, is best explained through the *embodied learning* framework, which holds that physical interaction with a learning environment, even a simulated one, recruits motor and proprioceptive systems that reinforce cognitive encoding and procedural automatization.⁵¹ In the context of speaking skills, this translates to the finding that motor speech practice within a VR environment produces stronger gains in fluency and accuracy than purely receptive or text-mediated practice,⁵² a pattern confirmed by studies in the corpus showing that repeated conversational simulation in VR

⁴⁸ Congchao Hua and Jia Wang, "Virtual Reality-Assisted Language Learning: A Follow-up Review (2018–2022)," *Frontiers in Psychology* 14 (2023): 1153642, <https://doi.org/10.3389/fpsyg.2023.1153642>.

⁴⁹ Yuh-shihng Chang et al., "Enhancing English-Learning Performance through a Simulation Classroom for EFL Students Using Augmented Reality—A Junior High School Case Study," *Applied Sciences* 10, no. 21 (2020): 7854, <https://doi.org/10.3390/app10217854>; Ho et al., "Applying Game-Based Experiential Learning to Comprehensive Sustainable Development-Based Education."

⁵⁰ Çelik and Yangin Ersanlı, "The Use of Augmented Reality in a Gamified CLIL Lesson and Students' Achievements and Attitudes: A Quasi-Experimental Study"; Asbulah et al., "Teachers' Attitudes Towards the Use of Augmented Reality Technology in Teaching Arabic in Primary School Malaysia."

⁵¹ Orly Fuhrman et al., "The Moving Learner: Object Manipulation in Virtual Reality Improves Vocabulary Learning," *Journal of Computer Assisted Learning* 37, no. 3 (2021): 672–83, <https://doi.org/10.1111/jcal.12515>.

⁵² Fuhrman et al.

is significantly associated with improved speaking performance.⁵³ The anonymity afforded by avatar-mediated interaction further reduces the affective load of speaking performance,⁵⁴ enabling the kind of uninhibited, high-frequency practice that is the primary driver of procedural fluency in language production.⁵⁵

These differential mechanisms have a direct implication for instructional design: AR and VR are most effective not as alternatives but as sequential complements within a single integrated framework.⁵⁶ AR is optimally positioned as the medium for *concept introduction and vocabulary priming*, establishing the referential and conceptual foundations that speaking tasks presuppose.⁵⁷ VR is optimally positioned as the medium for *communicative rehearsal and fluency consolidation*, providing the situated, social practice environment in which those foundations are activated and automatized.⁵⁸ This complementarity, as Khasawneh specifically argues, suggests that the instructional *sequencing* of the two technologies,

⁵³ Rahman et al., "The Use of Virtual Reality Platforms to Improve Students' Speaking Skills"; Di Fuccio et al., "Co-Created Augmented Reality App and Its Impact on the Effectiveness of Learning a Foreign Language and on Cultural Knowledge."

⁵⁴ Di Fuccio et al., "Co-Created Augmented Reality App and Its Impact on the Effectiveness of Learning a Foreign Language and on Cultural Knowledge."

⁵⁵ Mohammed Alfadil, "Effectiveness of Virtual Reality Game in Foreign Language Vocabulary Acquisition," *Computers & Education* 153 (2020): 103893, <https://doi.org/10.1016/j.compedu.2020.103893>.

⁵⁶ Khasawneh, "Analyzing the Strategic Effects of AI-Powered Virtual and Augmented Reality Systems in English Language Education at the Tertiary Level."

⁵⁷ Kurniawan et al., "Revolutionizing Language Learning: Exploring the Efficacy of Augmented Reality Technology Through Assemblr Studio."

⁵⁸ Di Fuccio et al., "Co-Created Augmented Reality App and Its Impact on the Effectiveness of Learning a Foreign Language and on Cultural Knowledge."

rather than the choice between them, is the central design variable educators should optimize.⁵⁹

Challenges and Obstacles in the Implementation of AR and VR in Mahārat al-Kalām

The four categories of implementation challenges identified in the Results section (technological, pedagogical, user-related, and economic) are not independent constraints but form an interconnected system of barriers, as illustrated in Figure 3. Understanding their interactions, rather than treating each in isolation, is essential for developing implementation strategies that are both realistic and sustainable.

Figure 3
A multidimensional framework of AR and VR implementation challenges in mahārat al-kalām instruction

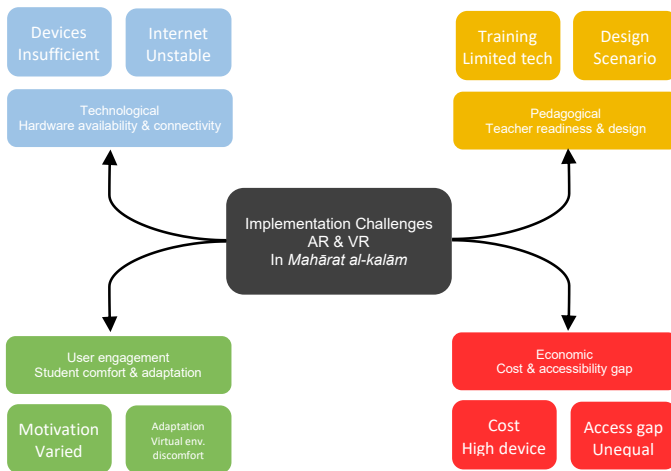


Figure 3 presents a visual taxonomy of the implementation challenges identified across the 12 reviewed articles, organized into four interconnected categories: technological, pedagogical, user engagement, and economic. Unlike a linear list of barriers, this map is designed to draw attention to the

⁵⁹ Khasawneh, “Analyzing the Strategic Effects of AI-Powered Virtual and Augmented Reality Systems in English Language Education at the Tertiary Level.”

relational structure of these challenges. This structure is analytically significant because each category of barrier amplifies or moderates the impact of the others. As the figure shows, no single barrier operates in isolation; technological limitations intersect with economic constraints, which in turn compound pedagogical unpreparedness and ultimately manifest as inconsistent user engagement. Understanding this interconnection is the necessary starting point for the systemic analysis that follows.

At the systemic level, the most analytically significant relationship is the one between economic and pedagogical barriers. The high cost of hardware and content development does not merely limit the number of institutions that can adopt AR and VR. Rather, it concentrates adoption within resource-rich contexts, which are also the contexts most likely to offer sustained teacher professional development.⁶⁰ This means that the institutions least able to afford devices are simultaneously the least likely to develop the pedagogical capacity to use them effectively, creating a compounding disadvantage that risks widening, rather than narrowing, existing educational inequity.⁶¹ This systemic dynamic explains why Jiang et al. specifically flag equitable access as a structural, rather than merely logistical, concern requiring policy-level intervention.⁶²

From a pedagogical perspective, the challenge extends beyond the technical competence required to operate AR and VR tools. The more profound issue is the *design gap*, which

⁶⁰ Jiang et al., "Virtual Reality and Augmented Reality-Supported K-12 STEM Learning: Trends, Advantages and Challenges"; Thangavel et al., "Revolutionizing Education Through Augmented Reality (AR) and Virtual Reality (VR): Innovations, Challenges and Future Prospects."

⁶¹ Mahmoud Hamash et al., "Virtual Reality in Post-Primary Education Research Trends from 2013 to 2024: A Systematic-Narrative Review," *Computers & Education: X Reality* 7 (2025): 100123, <https://doi.org/10.1016/j.cexr.2025.100123>.

⁶² Jiang et al., "Virtual Reality and Augmented Reality-Supported K-12 STEM Learning: Trends, Advantages and Challenges."

represents the distance between what teachers know about technology operation and what they need to know about technology-integrated instructional design.⁶³ Effective AR/VR integration in *mahārat al-kalām* requires teachers to reconceptualize the speaking lesson not as a performance event but as a rehearsal system, where iterative, low-stakes practice drives development.⁶⁴ This pedagogical reframing is unlikely to emerge from technical training alone; it requires structured, subject-specific professional development that connects technology affordances to communicative language teaching principles.⁶⁵ The study by Yusof et al. on Arabic teachers specifically corroborates this finding, reporting that readiness to use AR correlates not with general technology familiarity but with the degree of pedagogical training teachers have received in designing technology-based language tasks.⁶⁶

From the user perspective, the variability in student engagement with AR and VR technologies reflects a broader issue of *technological habituation*, which is the process by which learners develop the perceptual and attentional fluency needed to benefit from immersive environments.⁶⁷ Students who have not previously encountered these technologies must

⁶³ Asbulah et al., "Teachers' Attitudes Towards the Use of Augmented Reality Technology in Teaching Arabic in Primary School Malaysia"; Yusof et al., "The Readiness of KAFA Arabic Teachers Towards Utilizing Augmented Reality in Teaching Arabic Vocabularies."

⁶⁴ Asbulah et al., "Teachers' Attitudes Towards the Use of Augmented Reality Technology in Teaching Arabic in Primary School Malaysia."

⁶⁵ Jose Belda-Medina and José Ramón Calvo-Ferrer, "Integrating Augmented Reality in Language Learning: Pre-Service Teachers' Digital Competence and Attitudes Through the TPACK Framework," *Education and Information Technologies* 27, no. 9 (2022): 12123–46, <https://doi.org/10.1007/s10639-022-11123-3>.

⁶⁶ Yusof et al., "The Readiness of KAFA Arabic Teachers Towards Utilizing Augmented Reality in Teaching Arabic Vocabularies."

⁶⁷ Momenipour et al., "Board 127: Work in Progress: Strategizing the Integration of VR and AR in STEM Education: Aligning Educational, Organizational, and Technological Strategies."

simultaneously manage the cognitive demands of language production and the attentional demands of navigating an unfamiliar interface, which can produce elevated cognitive load and reduced engagement.⁶⁸ This finding suggests that implementation plans should include deliberate familiarization phases, prior to deploying AR or VR for language-specific tasks, during which students build baseline fluency with the interface without the concurrent demands of oral production.⁶⁹

From an economic perspective, the high cost of devices and the development of AR- and VR-based learning content represent barriers that are both absolute in terms of outright inaccessibility and relative, in that they distribute implementation quality unevenly across institutional contexts.⁷⁰ This creates an access gap that is particularly consequential in the Arabic language education context in Indonesia, where institutional resource disparities between urban and rural, public and private settings are already significant.⁷¹ Overall, these findings point toward a consistent conclusion: the effectiveness of AR and VR in *mahārat al-kalām* learning cannot be fully realized through technological investment alone. What is required is a coordinated, ecosystem-level response encompassing policy support for equitable device access, sustained investment in

⁶⁸ Mike Minwen Zhang et al., "Analyzing and Comparing Augmented Reality and Virtual Reality Assisted Vocabulary Learning: A Systematic Review," *Frontiers in Virtual Reality* 6 (2025): 1522380, <https://doi.org/10.3389/frvir.2025.1522380>.

⁶⁹ Momenipour et al., "Board 127: Work in Progress: Strategizing the Integration of VR and AR in STEM Education: Aligning Educational, Organizational, and Technological Strategies."

⁷⁰ Thangavel et al., "Revolutionizing Education Through Augmented Reality (AR) and Virtual Reality (VR): Innovations, Challenges and Future Prospects."

⁷¹ Thangavel et al.; Jiang et al., "Virtual Reality and Augmented Reality-Supported K-12 STEM Learning: Trends, Advantages and Challenges."

pedagogically-grounded teacher development, and learner-centered familiarization pathways that treats technology adoption as a systemic rather than merely instrumental challenge.⁷²

Conclusion

The integration of Augmented Reality (AR) and Virtual Reality (VR) into Arabic language learning significantly enhances speaking skills by enabling students to practice in more authentic contexts. AR provides contextual visualization, while VR offers immersive simulated environments. These technologies function not merely as supporting media but as learning environments capable of enhancing communicative interaction and student engagement. However, implementation faces multidimensional challenges. Infrastructure limitations, teachers' pedagogical readiness, and economic constraints remain significant obstacles to optimal application, particularly in resource-limited institutions. Success therefore depends on comprehensive support encompassing institutional policies, human resource development, and equitable technology access.

This study's primary contribution lies in presenting a systematic synthesis using the PRISMA framework to map the complementary roles of AR and VR in developing *mahārat al-kalām*. Unlike previous studies examining these technologies separately, this work identifies patterns of pedagogical complementarity. The findings suggest that immersive technology-based learning must be understood as a pedagogical ecosystem combining cognitive, affective, and social dimensions. Practically, the study recommends

⁷² Jiang et al., "Virtual Reality and Augmented Reality-Supported K-12 STEM Learning: Trends, Advantages and Challenges"; Hamash et al., "Virtual Reality in Post-Primary Education Research Trends from 2013 to 2024: A Systematic-Narrative Review."

integrated instructional designs positioning AR for concept introduction and VR for communicative practice.

Future research should explore the long-term impact of AR and VR use and develop more contextually adaptive learning models across diverse educational settings and infrastructure conditions. Ultimately, AR and VR in Arabic language learning contribute not only to pedagogical innovation but to creating a more inclusive and sustainable language learning system.

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