Integrating Augmented Reality in Primary Arabic Vocabulary Instruction: Teachers' Acceptance, Readiness, and Pedagogical Implications

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Abstract

Vocabulary acquisition in Arabic language education, especially in primary schools, is still a fundamental and difficult area of teaching due to the complex morphology and abstract linguistic characteristics of the Arabic language. While there is an increase in the adoption of AR-based instruction, little empirical research exists to assess teachers' acceptance and willingness to adopt AR in teaching Arabic vocabulary, particularly within the context of private primary schools. This paper will examine the degree of acceptance and readiness of teachers to incorporate augmented reality into their Arabic vocabulary instruction in private primary schools in Selangor, Malaysia. This study employed a quantitative methodology to collect data from 115 Arabic language teachers through a validated questionnaire based on previously developed technology acceptance and readiness models. Results indicated that teachers had a high degree of acceptance toward the use of AR in Arabic vocabulary instruction, which reflects positively on the perceived instructional value and pedagogical potential of AR. Results also showed that teacher readiness was rated as moderate to high with knowledge readiness being the most prominent dimension, whereas technological infrastructure readiness was rated the lowest. A strong positive correlation was shown between teacher's acceptance and readiness indicating that those who have higher levels of preparedness will have greater acceptance of incorporating AR into their instruction.

Keywords: Augmented Reality, Arabic Vocabulary, Teacher Acceptance, Teacher Readiness, Arabic language

Introduction

The integration of emerging technologies into language education has transformed how educators approach teaching, yet little is known about how such innovations are adopted in non-Western contexts or in less commonly taught languages. Arabic language instruction in primary schools presents unique challenges and opportunities for technological integration that remain underexplored.

Arabic language education plays a significant role in the educational landscape of Malaysia, particularly in Islamic-based and private primary schools where Arabic is offered as a core or supplementary subject. As a language closely linked to the religious, cultural, and intellectual heritage of Muslims, acquiring competency in Arabic is regarded as an important educational goal for Muslim learners. At the primary level, vocabulary development forms the foundation of language acquisition, serving as the initial step toward higher-order linguistic skills such as reading comprehension, grammar application, sentence construction, and meaningful communication.

Despite its importance, Arabic vocabulary acquisition remains challenging for many young learners. The linguistic characteristics of Arabic including its morphological richness, root-based word formation system, diverse vocabulary forms, and the use of diacritical marks, create substantial cognitive demands, particularly for non-native speakers. Moreover, traditional teaching methods that rely heavily on rote memorization, repetition, and textbook-based learning often limit students' engagement and reduce opportunities to contextualize vocabulary in meaningful situations. As a result, learners may struggle with long-term retention and the practical application of newly acquired vocabulary in authentic communicative contexts.

To address these challenges, educational technology has increasingly been explored as a means of enhancing language learning experiences. Among emerging technologies, augmented reality (AR) has gained growing attention for its ability to create interactive and engaging learning environments by integrating virtual elements into real-world settings. AR-based instruction allows learners to visualize abstract concepts, supports multimodal learning, and promotes active participation, features that are particularly beneficial for young learners. Previous studies have demonstrated that AR can support vocabulary learning by providing visual representations, contextualized learning experiences, and interactive engagement that contribute to deeper cognitive processing.

However, while the pedagogical potential of AR has been widely discussed, its application within Arabic language education remains limited, particularly at the primary school level. Existing research on AR in language learning has predominantly focused on widely taught languages such as English, leaving relatively few studies that examine its use for Arabic vocabulary instruction. Furthermore, much of the current literature emphasizes students' perceptions and learning outcomes, with less attention given to teachers, who play a central role in implementing technological innovations in classroom settings.

The successful integration of AR in education depends largely on teachers' acceptance of technology and their readiness to apply it effectively. Teachers' acceptance refers to their beliefs, attitudes, and intentions regarding the use of technology, which are often shaped by perceptions of usefulness and ease of use. Teachers' readiness, meanwhile, encompasses broader factors, including technological competence, pedagogical knowledge, openness to innovation, and the availability of institutional and technical support. Without sufficient readiness, positive attitudes toward technology may not translate into effective classroom implementation.

This issue is particularly relevant in the Malaysian context, where private primary schools are increasingly encouraged to adopt innovative instructional approaches aligned with 21st-century learning goals. Nevertheless, disparities in technological infrastructure, professional development opportunities, and institutional support may influence teachers' ability and willingness to integrate AR into teaching practices. Consequently, examining teachers' acceptance and readiness becomes essential for identifying strengths and addressing barriers that may hinder sustainable AR integration in Arabic language instruction.

Grounded in established educational and technology adoption theories including constructivism, connectivism, self-determination theory, interest theory, the Technology Acceptance Model (TAM), and Technological Pedagogical Content Knowledge (TPACK), this study investigates teachers' acceptance of augmented reality for teaching Arabic vocabulary, their readiness to implement AR in instructional practice, and the relationship between these two constructs. The study focuses on Arabic language teachers in private primary schools in Selangor, Malaysia.

This study fills a critical gap in the social sciences by examining an underexplored context: the adoption of AR in Arabic language education at the primary level. Unlike previous studies that primarily focus on students' outcomes or widely taught languages, this research investigates teachers' acceptance and readiness as interconnected factors shaping the integration of AR. By focusing on teachers in private primary schools within a non-Western educational setting, the study provides valuable insights into how human attitudes, institutional support, and technological factors influence the adoption of educational innovations. These findings contribute to understanding technology integration from a social and behavioural perspective while offering practical implications for educational policy and teacher professional development.

Specifically, the study aims to determine the level of teachers' acceptance of augmented reality in teaching Arabic vocabulary, examine their readiness to integrate AR into instructional practice, and explore the relationship between acceptance and readiness. By addressing this underexplored area within both educational technology and Arabic language education, the study provides empirical evidence to inform instructional practices, teacher training programs, and policy development related to technology-supported language learning in primary education.

Literature Review and Theoretical Framework
Augmented Reality in Education

Augmented Reality (AR) is a developing educational technology that allows users to interact with digital content that is connected to real world environments, thereby enabling learners to engage with virtual objects within the context of the physical environment. Although Virtual Reality (VR) provides learners with a completely immersive digital environment; AR does so by enhancing the real-world experience through the addition of digital elements such as images, animations, audio, and/or text that are overlaid on top of the user's physical environment. Due to its ability to allow learners to engage with their physical environment and provide them with the opportunity to physically interact with their learning environment; AR lends itself well to the classroom setting.

Research suggests that AR may help to increase learner engagement, motivation, and conceptual understanding. With visual and interactive representations of abstract concepts; AR promotes both experiential and constructivist learning practices. Learners are able to explore content in an active manner, manipulate digital objects, and receive immediate feedback from the system, all of which can enhance cognitive processing and understanding.

The research conducted using AR in classrooms has demonstrated the potential of AR to positively impact student learning outcomes. For example, researchers have found that AR has been useful in supporting vocabulary development by linking words to visual representations, contextual scenarios, and real-life objects. The use of multimodal learning experiences to support vocabulary development is consistent with cognitive theories that suggest that visual and contextual input is essential for vocabulary development.

While there is evidence suggesting the benefits of using AR in formal educational settings, there are several reasons why the use of AR in formal educational settings varies significantly. Some of the factors contributing to this variability include the quality of the educational technology infrastructure, the level of preparedness of teachers to effectively integrate AR into instruction, and the extent to which AR is aligned with instructional goals. These factors highlight the need for researchers to examine both the effectiveness of AR as a learning tool and the conditions necessary for successful implementation of AR in formal educational settings.

Augmented Reality in Language and Vocabulary Learning
Within the realm of language education, Augmented Reality (AR) is being utilized as an increasing number of tools for improving vocabulary acquisition. The processes associated with vocabulary acquisition including repeated exposures, meaningful contexts, and multiple modes of input can all be supported through AR-based applications. AR allows students to relate new vocabulary to visual representations, motion graphics, and tangible objects, therefore, building stronger semantic relationships and reinforcing memory retention.

The literature on language education suggests that AR-based vocabulary instruction promotes student motivation and engagement; this effect appears to be most pronounced in younger learners who generally find interactive technology appealing. Additionally, by converting traditional vocabulary lessons into interactive experiences, AR reduces cognitive load for learners and encourages them to participate actively in the process. These aspects are particularly relevant to the development of vocabulary in Arabic, as learners may struggle to comprehend the abstract meanings of some words and/or unfamiliar script of the language.

There is a little research about using AR in the context of language learning regarding the Arabic language. There are also a few studies examining the teacher's perspective on AR in language learning in general and the teacher's acceptance and readiness to implement AR-based vocabulary instruction. Because teachers are central to developing, implementing, and maintaining innovative instructional methods, their perspectives should receive greater emphasis.

Teacher Acceptance of Educational Technology

Teacher acceptance is one of the most important factors that influence how often teachers will adopt and continue to use educational technology. Acceptance of technology generally refers to the attitudes, beliefs and intentions of teachers regarding the use of technology in instructional settings. A model that has been widely applied to understand the acceptance of technology is the Technology Acceptance Model (TAM). This model suggests that two variables are primarily responsible for teachers' acceptance of technology: perceived usefulness and perceived ease of use.

When teachers believe technology is useful for teaching and learning, and that they can use the technology effectively, they are more likely to be accepting of the technology. When teachers have positive attitudes toward technology, they are more likely to want to try out new technology tools, to adjust their instructional methods and to incorporate technology into their curriculum. When teachers have negative perceptions of technology or are uncertain about its use, they are less likely to be willing to try using the technology and may even resist using the technology or merely go through the motions of implementing technology without fully utilizing the capabilities of the technology.

Research on educational technology adoption consistently highlights the importance of teacher acceptance in determining the success of technology integration initiatives. In the context of AR, teachers' acceptance is influenced not only by perceptions of instructional value but also by concerns related to classroom management, technical complexity, and alignment with curricular goals.

Teacher Readiness for Augmented Reality Integration

While acceptance represents what teachers think about (and intend to do with) technology, readiness is a much broader construct that indicates whether teachers have the resources (or lack thereof), knowledge, and experience necessary for effective use of technology. Readiness as it pertains to teachers encompasses technological knowledge, pedagogical skills, an attitude towards innovative methods, and access to both technological infrastructure and institutional support for its implementation. Even when a teacher expresses a positive outlook on technology, if they are lacking in one of these areas of readiness, it will significantly inhibit their ability to appropriately implement this technology.

Technological readiness is defined as having the available, reliable devices, software, adequate Internet connection and technical support for all users. Skills readiness involves teachers' ability to utilize the technology, and to incorporate the technology into instructional practice. Knowledge readiness reflects teachers' understanding of how technology can enhance learning outcomes. Attitudinal readiness relates to openness toward innovation and willingness to adapt teaching practices.

Studies regarding educational technology, specifically in regard to integrating technology into the classroom, indicate that many times the technological infrastructure is the limiting factor, especially in schools with limited resources. On the other hand, studies also show that teachers may understand the concept of technology and have a very positive attitude toward technology but still face difficulties with the technological infrastructure. This

finding supports the fact that readiness is a multi-dimensional construct which should be looked at from all aspects.

Theoretical Framework

The current study is founded upon multiple theoretical models for understanding technology utilization in educational settings.

Constructivist theory emphasizes student participation in learning and the development of knowledge through students' interactions and experiences. The constructivist model mirrors the participatory and experiential learning associated with AR-based instructional designs. Connectivism identifies digital networks and technologies as critical components of contemporary learning environments; therefore, connectivism provides further justification for the relevance of AR in today's educational settings.

Self-Determination Theory (SDT) and Interest Theory (IT) have been utilized to understand student motivation and involvement with learning, indicating that autonomy, competence, and interest are significant motivators for successful learning. AR-based instructional designs have the potential to promote these motivational elements via interactive, student-cantered learning experiences.

From the perspective of technology adoption, Technology Acceptance Model (TAM) represents an explanatory model for understanding teachers' acceptance of AR, based on teachers' perceptions of its utility and usability. Technological Pedagogical Content Knowledge (TPACK) is another explanatory model for understanding how technology, pedagogy, and content knowledge can be integrated in a manner consistent with achieving pedagogical objectives.

In addition to providing an explanatory model for each of these topics, the two models also provide insight into the necessity for technology tools to be aligned with both the pedagogical objectives and the content knowledge of teachers. By combining the theoretical perspectives above, this study will develop a conceptual model that views teacher acceptance and readiness as related concepts that together impact the effectiveness of AR-based instruction of Arabic vocabulary.

Methodology

Research Design

This study employed a quantitative research design with a survey method to examine teachers' willingness to accept and their readiness to incorporate augmented reality (AR) into Arabic vocabulary instruction at the primary school level. Quantitative research was selected due to its ability to provide a systematic way of measuring attitudes, perceptions and readiness levels across a relatively large sample, as well as determining relationships between key variables.

The survey design allowed for collecting consistent data from the respondents over a set time allowing for the use of both descriptive and inferential statistical analysis. Utilizing a survey design also fits with much of the existing literature on technology acceptance and readiness that typically utilize a quantitative methodology to establish patterns and relationships among the variables of interest.

Participants and Sampling

The participants of the study consisted of 115 Arabic language teachers from selected private primary schools in Selangor, Malaysia. Convenience sampling was employed due to accessibility and practical considerations, particularly the availability of teachers and institutional consent. Although convenience sampling limits generalizability, it is commonly used in educational research where access to participants is constrained.

The selected participants represented teachers with varying levels of teaching experience and exposure to educational technology. All participants were actively involved in teaching Arabic at the primary level, ensuring that their responses were directly relevant to the context of the study.

Research Instrument

Data were collected using a structured questionnaire adapted from established technology acceptance and readiness models. The questionnaire comprised three main sections. The first section focused on teachers' acceptance of augmented reality, measuring constructs related to perceived usefulness, attitudes, and intention to use AR in Arabic vocabulary instruction. The second section examined teachers' readiness for AR integration, encompassing multiple dimensions, including technological infrastructure readiness, skills readiness, knowledge readiness, and attitudinal readiness. The final section gathered general information related to acceptance and readiness.

The instrument consisted of 42 items measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The use of a Likert scale enabled participants to express the degree of their agreement with each statement and facilitated quantitative analysis.

Validity and Reliability

To ensure content validity, the questionnaire was reviewed by subject matter experts with expertise in educational technology and Arabic language education. Feedback from the experts was used to refine item clarity, relevance, and alignment with the study objectives. A pilot study was subsequently conducted to assess the reliability of the instrument.

Reliability analysis was performed using Cronbach's alpha coefficients. The results indicated acceptable to excellent levels of internal consistency across all sections of the questionnaire, confirming that the instrument was reliable for measuring teachers' acceptance and readiness to integrate augmented reality in Arabic vocabulary instruction.

Data Collection Procedure

Data collection took place after the required school permissions had been acquired. Arabic language teachers were provided with a questionnaire which explained the study's objective and assured of the confidentiality and anonymity of their responses. Participation in this study was on a voluntary basis, and prior to collecting the data, informed consent was obtained. Completed questionnaires were collected to the researcher and screened for completion prior to inclusion in the quantitative data analysis.

Data Analysis

Data analysis was performed using a statistical software. The descriptive statistics, including means and standard deviations were computed to determine the levels of teachers' acceptance and readiness to integrate augmented reality in Arabic vocabulary instruction. These analyses provided an overview of participants' perceptions and preparedness.

Pearson's correlation analysis was used to determine if there is a relationship between teachers' acceptance and their readiness to use Augmented Reality in teaching Arabic vocabulary. This inferential analysis enabled the identification of the strength and direction of the relationship between the two variables, thereby addressing the research questions related to technology integration.

Results

Teachers' Acceptance of Augmented Reality

Descriptive statistics were used to measure teacher's acceptability of using Augmented Reality (AR) for teaching Arabic vocabulary. Overall, the findings indicate that teachers showed a high degree of acceptability for using AR as an additional resource for instructional purposes. Positive perceptions regarding the useful-ness and instructional value of AR for improving students' learning of vocabulary were evident in the mean scores across all items related to acceptance.

Teachers also generally agreed with the notion that AR can be effective at increasing student engagement with the material, improve the student's conceptual understanding of vocabulary, and provide students with a richer learning experience with interactive and visual components. Respondents further indicated a willingness to incorporate AR into their teaching practices, which suggests that they are open to incorporating new technology into Arabic Language Instruction.

Readiness for Augmented Reality Integration

Teachers' readiness to integrate augmented reality in Arabic vocabulary instruction was examined across multiple dimensions, including technological infrastructure readiness, skills readiness, knowledge readiness, and attitudinal readiness. The overall readiness level was found to be moderate to high.

Among the readiness dimensions, knowledge readiness recorded the highest mean scores, indicating that teachers possessed a strong conceptual understanding of AR and its potential pedagogical benefits. Attitudinal readiness also demonstrated relatively high levels, reflecting teachers' positive dispositions toward adopting AR-based instructional approaches.

Skills readiness showed moderate levels, suggesting that while teachers were generally confident in using technology, there remains a need for further professional development to enhance practical implementation skills. Technological infrastructure readiness recorded comparatively lower mean scores, highlighting challenges related to access to devices, software, and technical support within school environments.

Relationship between Teachers' Acceptance and Readiness

Pearson correlation analysis was conducted to examine the relationship between teachers' acceptance and readiness to integrate augmented reality in Arabic vocabulary instruction. The results revealed a strong positive correlation between acceptance and readiness.

This finding indicates that teachers who reported higher levels of readiness were also more likely to demonstrate greater acceptance of AR integration. Conversely, lower levels of readiness were associated with reduced acceptance. The strength and direction of the correlation suggest a meaningful relationship between these constructs, emphasizing the role of preparedness in influencing teachers' acceptance of educational technologies.

Discussion

The findings of this study provide valuable insights into teachers' acceptance and readiness to integrate augmented reality (AR) in Arabic vocabulary instruction at the primary school level. Overall, teachers demonstrated high acceptance and moderate-to-high readiness, with a significant positive correlation between the two constructs. These results have important implications for educational practice, theory, and policy.

Teachers' Acceptance of Augmented Reality

The high level of teacher acceptance reported in this study suggests that teachers view AR as a beneficial tool for teaching Arabic vocabulary, and see it as enhancing student engagement, facilitating comprehension, and providing students with an interactive and visually based learning experience. The findings from this study are consistent with prior studies examining the use of AR in language education, which have identified AR as an effective method for increasing the depth and breadth of vocabulary learned by students and engaging them in an active learning process (Anuar, Nizar, & Ismail, 2021).

These findings also support the Technology Acceptance Model (TAM) (Davis, 1989), which states that the perceived usefulness and ease of use of a technology will significantly impact the decision to adopt a technology. Teachers' positive views of AR indicate that they believe there are practical advantages to using technology in their classrooms and these beliefs can encourage technology adoption and continued use.

Teachers' Readiness for AR Integration

The analysis of readiness dimensions revealed that knowledge readiness emerged as the strongest, followed by attitudinal and skills readiness, while technological infrastructure readiness was comparatively lower. Knowledge readiness indicates that teachers possess a strong conceptual understanding of AR's instructional potential, demonstrating awareness of how AR can support language learning outcomes. Attitudinal readiness reflects teachers' openness to innovation and willingness to experiment with AR-based approaches.

Skills readiness, although moderate, suggests that some teachers may require additional professional development to confidently implement AR in classroom settings. Technological infrastructure readiness scored the lowest, highlighting the importance of adequate access to devices, software, and technical support. These findings align with prior

research emphasizing that infrastructure and resource availability are critical enablers of effective technology integration (Hughes & Smail, 2019).

Relationship between Acceptance and Readiness

The strong positive correlation between teachers' acceptance and readiness underscores the interdependent nature of these constructs. Teachers with greater preparation (both through knowledge and practical skill) will be far more likely to use and accept AR technology as part of their instruction. Mishra and Koehler (2006) support this with the TPACK model which clearly emphasizes the integration of technological knowledge, pedagogical understanding, and content expertise as essential for effective technology adoption. Readiness can be seen as an enabler; it is what allows positive attitudes to result in instructional practice.

Conclusion and Implications

Conclusion

This study examined teachers' acceptance and readiness to integrate augmented reality (AR) in Arabic vocabulary instruction at the primary school level in private schools in Selangor, Malaysia. The findings indicate that teachers generally exhibit high acceptance of AR, recognizing its potential to enhance student engagement, facilitate understanding of vocabulary concepts, and support interactive learning. Overall readiness was moderate to high, with knowledge readiness emerging as the strongest dimension, while technological infrastructure readiness was comparatively lower. The study also revealed a strong positive correlation between acceptance and readiness, suggesting that teachers who are better prepared are more likely to adopt and implement AR effectively.

These results underscore the importance of both attitudinal and structural factors in the successful integration of technology in education. While positive perceptions of AR are essential, readiness in terms of skills, knowledge, and infrastructure plays a crucial enabling role in translating acceptance into practical classroom application. The study provides empirical evidence confirming that teacher preparedness is a key determinant of technology adoption in language education.

Practical Implications

The findings offer several practical implications for schools and educators:

Professional Development: Teachers need ongoing professional development training to improve their ability to teach using both technical and pedagogical skills when it comes to incorporating AR into their classroom instruction.

Technological Infrastructure: Schools need to provide teachers with the technical support necessary to implement AR effectively through having a good hardware system, software system and technical support system that is always available to them.

Curriculum Design: AR activities should be strategically aligned with Arabic vocabulary learning objectives to reinforce content understanding and ensure meaningful learning experiences.

References

Abandah, G. A., Suyyagh, A. E., & Abdel-Majeed, M. R. (2022). Transfer learning and multi-phase training for accurate diacritization of Arabic poetry. Journal of King Saud University - Computer and Information Sciences, 34(6), 3744–3757. https://doi.org/10.1016/j.jksuci.2022.04.005

Abdrabo, N. D. (2023, January 1). A glimpse at two major challenges in Modern Standard Arabic (MSA) learning: "Sandhi-variation" vs. "Agglutinative inflected word." ResearchGate.
https://www.researchgate.net/publication/368823645_A_Glimpse_at_Two_Major_Challenges_in_Modern_Standard_Arabic_MSA_Learning_

Abdul Razif Zaini, Z., Zakaria, N., Hamdan, H., Muhammad Redzaudin Ghazali, & Mohd Rufian Ismail. (2019). Pengajaran bahasa Arab di Malaysia: Permasalahan dan cabaran: Teaching of Arabic in Malaysia: Problems and challenges. Jurnal Pengajian Islam, 12(1), 47–57. https://jpi.kuis.edu.my/index.php/jpi/article/view/4

Ahammed, H. (2021). Challenges faced by teachers of learners with learning disability. ResearchGate.
https://www.researchgate.net/publication/351303413_Challenges_Faced_by_Teachers_of_Learners_with_Learning_Disability

Ahmad, N., Alias, F., Hamat, M., & Mohamed, S. (2024). Reliability analysis: Application of Cronbach's alpha in research instruments. https://appspenang.uitm.edu.my/sigcs/2024-2/Articles/20244_ReliabilityAnalysis-ApplicationOfCronbachsAlphaInResearchInstruments.pdf

Ahmed, S. K. (2024). Research methodology simplified: How to choose the right sampling technique and determine the appropriate sample size for research. Oral Oncology Reports, 12, 100662. https://doi.org/10.1016/j.oor.2024.100662

Akram, H., Abdelrady, A. H., Al-Adwan, A. S., & Ramzan, M. (2022). Teachers' Perceptions of Technology Integration in Teaching-Learning Practices: A Systematic Review. Frontiers in Psychology, 13(1). https://doi.org/10.3389/fpsyg.2022.920317

Akçayır, M., & Akçayır, G. (2017). Advantages and challenges associated with augmented reality for education: A systematic review of the literature. Educational Research Review, 20, 1–11. https://doi.org/10.1016/j.edurev.2016.11.002

Al, G. A., & Lakulu, M. M. (2021). Challenges analysis for using augmented reality in education: A review. Semantic Scholar. https://www.semanticscholar.org/paper/Challenges-Analysis-for-Using-Augmented-Reality-in-Al-Lakulu/4db6710c6cb0efbf2e63437c88c79dc55edb8c7d

Alahmadi, A., & Foltz, A. (2020). Effects of language skills and strategy use on vocabulary learning through lexical translation and inferencing. Journal of Psycholinguistic Research, 49(6), 975–991. https://doi.org/10.1007/s10936-020-09720-9

Al-Ansi, A. M., Jaboob, M., Garad, A., & Al-Ansi, A. (2023). Analyzing augmented reality (AR) and virtual reality (VR) recent development in education. Social Sciences & Humanities Open, 8(1), 100532. https://doi.org/10.1016/j.ssaho.2023.100532

Alchundia, I. M., Zabala, J. A., & Murillo, M. S. (2022). Análisis del uso de las TICs aplicadas en el proceso de enseñanza-aprendizaje en las clases virtuales: Caso ciudad de Milagro. Sapienza International Journal of Interdisciplinary Studies, 3(1), 786–795. https://doi.org/10.51798/sijis.v3i1.262

Aldossari, S., & Alsuhaibani, Z. (2021). Using augmented reality in language classrooms: The case of EFL elementary students. Advances in Language and Literary Studies, 12(6), 1–8. https://doi.org/10.7575/aiac.alls.v.12n.6.p.1

Al-Huri, I. (2015). Arabic language: Historic and sociolinguistic characteristics. English Literature and Language Review, 28–36, 28–36. https://doi.org/10.13140/RG.2.2.16163.66089/1

Alzahrani, N. M. (2020). Augmented reality: A systematic review of its benefits and challenges in e-learning contexts. Applied Sciences, 10(16), 5660. https://doi.org/10.3390/app10165660

Anuar, S., Nizar, N., & Ismail, M. A. (2021). The impact of using augmented reality as teaching material on students' motivation. Asian Journal of Vocational Education and Humanities, 2(1), 1–8. https://doi.org/10.53797/ajvah.v2i1.1.2021

Apuke, O. D. (2017). Quantitative research methods: A synopsis approach. ResearchGate. https://www.researchgate.net/publication/320346875_Quantitative_Research_Methods_A_Synopsis_Approach

Aqib, M. A., Ekawati, R., & Khabibah, S. (2024). A modified technological pedagogical and content knowledge (TPACK) framework: A systematic literature review. Multidisciplinary Reviews, 8(6), 2025167. https://doi.org/10.31893/multirev.2025167

Arena, F., Collotta, M., Pau, G., & Termine, F. (2022). An overview of augmented reality. Computers, 11(2), 28. https://doi.org/10.3390/computers11020028

Asbulah, L. H., Nur Nordin, H., & Musab Sahrim. (2024). Enhancing Arabic vocabulary mastery through augmented reality: A study on AR-Mufradat application for primary school students. International Journal of Advanced Research, 12(10), 283–291. https://doi.org/10.21474/ijar01/19640

Asbulah, L. H., Sahrim, M., Soad, N. F. A. M., Rushdi, N. A. A. M., & Deris, M. A. H. M. (2022). 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(10). https://doi.org/10.14569/ijacsa.2022.0131055

Asiah, N., Lakilaki, E., Khusnadin, M. H., Eprilia, W., Negara, H. S., & Rizky, M. (2025). Learning transformation: The application of augmented reality media to improve motivation and interest in learning among elementary school students in the 5.0 era. Riwayat: Educational Journal of History and Humanities, 8(3), 5337–5345. https://doi.org/10.24815/jr.v8i3.49008

Aytaç, A., Alemdar, M., Akay, Y., & Avcu, Y. E. (2024). Fostering tech integration: teachers' attitudes mediating lifelong learning and technology Integration Self-Efficacy. Participatory Educational Research, 11(6), 112–133. https://doi.org/10.17275/per.24.82.11.6

Balkan Kiyici, F. (2018). Primary school students' perceptions of technology. Malaysian Online Journal of Educational Technology, 6(4), 53–66. https://doi.org/10.17220/mojet.2018.04.005

Belda-Medina, J., & Marrahi-Gomez, V. (2023). The impact of augmented reality (AR) on vocabulary acquisition and student motivation. Electronics, 12(3), 749. https://doi.org/10.3390/electronics12030749

Bower, M., DeWitt, D., & Lai, J. W. M. (2020). Reasons associated with preservice teachers' intention to use immersive virtual reality in education. British Journal of Educational Technology, 51(6), 2215–2233. https://doi.org/10.1111/bjet.13009

Cahyani, A., Fauzan, M., Putri, K. A. R., Larasati, A. D., Sakdiyah, N. H., & Tohuri, A. (2021). Arabic vocabulary: Konsep aplikasi berbasis augmented reality untuk meningkatkan penguasaan kosakata bahasa Arab. JoLLA: Journal of Language, Literature, and Arts, 1(8), 1158–1170. https://doi.org/10.17977/um064v1i82021p1158-1170

Chen, Y., Wang, Q., Chen, H., Song, X., Tang, H., & Tian, M. (2019). An overview of augmented reality technology. Journal of Physics: Conference Series, 1237(2), 022082. https://doi.org/10.1088/1742-6596/1237/2/022082

Cheung, G., Chan, K., Brown, I., & Wan, K. (2016). Teachers' knowledge and technology acceptance: A study on the adoption of clickers. Rogers. https://www.researchgate.net/publication/316237552_Teachers

Crogman, H. T., Cano, V. D., Pacheco, E., Sonawane, R. B., & Boroon, R. (2025). Virtual reality, augmented reality, and mixed reality in experiential learning: Transforming educational paradigms. Education Sciences, 15(3), 303. https://doi.org/10.3390/educsci15030303

Dalati, S., & Carlos, J. (2018). Surveys and questionnaires. ResearchGate. https://www.researchgate.net/publication/324117644_Surveys_and_Questionnaires

Daniel, E. (2016). The usefulness of qualitative and quantitative approaches and methods in researching problem-solving ability in science education curriculum. Journal of Education and Practice, 7(15), 91–100. https://files.eric.ed.gov/fulltext/EJ1103224.pdf

Dhaas, A. (2024). Augmented reality in education: A review of learning outcomes and pedagogical implications. American Journal of Computing and Engineering, 7(3), 1–18. https://doi.org/10.47672/ajce.2028

Dickson Mdhlalose, & Mlambo, G. (2023). Integration of technology in education and its impact on learning and teaching. ResearchGate; Sciencedomain International. https://www.researchgate.net/publication/372478475_Integration_of_Technology_in_Education_and_its_Impact_on_Learning_and_Teaching

Dini, G., & Dalle Mura, M. (2015). Application of augmented reality techniques in through-life engineering services. Procedia CIRP, 38, 14–23. https://doi.org/10.1016/j.procir.2015.07.044

Egunjobi, D., & Adeyeye, O. J. (2024). Revolutionizing Learning: The Impact of Augmented Reality (AR) And Artificial Intelligence (AI on Education. International Journal of Research Publication and Reviews, 5(10), 1157–1170. https://doi.org/10.55248/gengpi.5.1024.2734

El Filali, Y., & Krit, S. (2018). Augmented reality types and popular use cases. In Proceedings of the 1st International Conference of Computer Science and Renewable Energies. https://doi.org/10.5220/0009776301070110

Endot, Z., Jamaluddin, R., Ayub, A. F. M., & Puad, M. H. M. (2021). Teacher readiness in implementing the teaching of design and technology and its relationship with self-efficacy and intrinsic motivation. International Journal of Human Resource Studies, 11(4S), 111. https://doi.org/10.5296/ijhrs.v11i4s.19234

Fagbemi, O. (2023). How can AR be used to improve student engagement and learning outcomes? ResearchGate. https://www.researchgate.net/publication/376516389_How_can_AR_be_used_to_improve_student_engagement_and_learning_outcomes

Fasihah, N., Abas, U.-H., Jaffar, M. N., Ahmad, & Norkhairul, M. (2024). Augmented reality technology for Arabic vocabulary learning as a model of Quran reflection for hearing-impaired adults. Ijaz Arabi Journal of Arabic Learning, 7(3), 1117–1129. https://doi.org/10.18860/ijazarabi.v7i3.26641

Fengyu, Z. (2023). The impact of vocabulary learning methods on students' vocabulary application skills. English Language Teaching and Linguistics Studies, 5(4), 206. https://doi.org/10.22158/eltls.v5n4p206

Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and Learning with Technology: Effectiveness of ICT Integration in Schools. International Journal of Research in Education and Science, 1(2), 175–191. https://doi.org/10.21890/ijres.23596

Ghasemi, B., & Hashemi, M. (2011). Foreign language learning during childhood. Procedia - Social and Behavioral Sciences, 28(28), 872–876. https://doi.org/10.1016/j.sbspro.2011.11.160

Golzar, J., Tajik, O., & Noor, S. (2022). Convenience sampling. International Journal of English Language and Literature Studies, 1–2, 72. https://doi.org/10.22034/ijels.2022.162981

Gopnik, A. (2015). When younger learners can be better (or at least more open-minded) than older ones. Current Directions in Psychological Science. https://journals.sagepub.com/doi/10.

Gu, P. (2020). Vocabulary learning in a second language: Person, task, context and strategies. https://www.semanticscholar.org/paper/Vocabulary-Learning-in-a-Second-Language%3A-Person%2C-Gu/b2cdb327928cdcb9063c9b3ac8e8532c618b702c?sort=relevance&queryString=vocabulary%20learning%20strategies%20between%20learner%20of%20arabic%20major%5C

Gupta, S., Abbas, A. F., & Srivastava, R. (2022). Technology acceptance model (TAM): A bibliometric analysis from inception. Journal of Telecommunications and the Digital Economy, 10(3), 77–106. https://doi.org/10.18080/jtde.v10n3.598

Hady, R., Nasri, U., Multazam Hajras, Muhammad Hasyim, & Rahmatullah, A. J. (2025). The revolution of Arabic language learning: Integration of digital technology in 21st century education. Jurnal Ilmiah Profesi Pendidikan, 10(2), 1593–1599. https://doi.org/10.29303/jipp.v10i2.3444

Hakim, A. R., Muassomah, M., & Salsabila, E. L. (2023). Arabic learning challenges. 475–482. https://doi.org/10.2991/978-2-38476-002-2_45

Hanefarezan Asbulah, L., Sahrim, M., Mohd Soad, N. F. A., Mohd Rushdi, N. A. A., & Deris, M. A. H. (2022). 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(10), 465–466. https://thesai.org/Downloads/Volume13No10/Paper_55-Teachers_Attitudes_Towards_the_Use_of_Augmented_Reality_Technology.pdf

Hasnah, S., Idhan, M., & Jabir, M. (2024). Contextual teaching strategies in Arabic language education: Bridging theory and practice for enhanced learning outcomes. Deleted Journal, 19(2), 281–290. https://doi.org/10.21111/attadib.v19i2.13091

Heidar (Amir) Pirzadeh, S., Shanian, S., Abdelwahab Hamou-Lhadj, & Ali Reza Mehrabian. (2011). The concept of stratified sampling of execution traces. ResearchGate. https://www.researchgate.net/publication/221219703_The_Concept_of_Stratified_Sampling_of_Execution_Traces

Herawati, E., & None Ainil Mawaddah. (2023). Enriching Arabic vocabulary: Examining the impact of Quranic word-by-word translation on student proficiency. Peradaban Journal of Interdisciplinary Educational Research, 1(1), 34–51. https://doi.org/10.59001/pjier.v1i1.98

Herlo, D. (2017). Connectivism: A new learning theory? ResearchGate. https://www.researchgate.net/publication/317155829_Connectivism_A_New_Learning_Theory

Hero, J. (2020). Teachers' preparedness and acceptance of information and communication technology (ICT) integration and its effect on their ICT integration practices. Puissant – a Multidisciplinary Journal, 1(1), 59–76. https://puissant.stepacademic.net

Herpratiwi, H., & Tohir, A. (2022). Learning interest and discipline on learning motivation. International Journal of Education in Mathematics, Science and Technology, 10(2), 424–435. https://doi.org/10.46328/ijemst.2290

Haryati, R., & Salamah, U. (2024). Revitalizing Arabic vocabulary learning through the use of augmented reality media. Kitaba, 2(2), 113–128. https://doi.org/10.18860/kitaba.v2i2.25451

Hong, X., Zhang, M., & Liu, Q. (2021). Preschool teachers' technology acceptance during the COVID-19: An adapted technology acceptance model. Frontiers in Psychology, 12, 691492. https://doi.org/10.3389/fpsyg.2021.691492

Hoque, E. (2018). Memorization: A proven method of learning. ResearchGate. https://www.researchgate.net/publication/330825027_Memorization_A_Proven_Method_of_Learning

Hu, J. (2024). The challenge of traditional teaching approach: A study on the path to improve classroom teaching effectiveness based on secondary school students' psychology. Lecture Notes in Education Psychology and Public Media, 50(1), 213–219. https://doi.org/10.54254/2753-7048/50/20240945

Jamrus, M. H. M., & Razali, A. B. (2021). Acceptance, readiness and intention to use augmented reality (AR) in teaching English reading among secondary school teachers in Malaysia. Asian Journal of University Education, 17(4), 312. https://doi.org/10.24191/ajue.v17i4.16200

Ismail, S. N., Omar, M. N., Don, Y., Purnomo, Y. W., & Kasa, M. D. (2022). Teachers' acceptance of mobile technology use towards innovative teaching in Malaysian secondary schools. International Journal of Evaluation and Research in Education (IJERE), 11(1), 120. https://doi.org/10.11591/ijere.v11i1.21872

Jalil, H. A., Rajakumar, M., & Zaremohzzabieh, Z. (2022). Teachers' acceptance of technologies for 4IR adoption: Implementation of the UTAUT model. International Journal of Learning Teaching and Educational Research, 21(1), 18–32. https://doi.org/10.26803/ijlter.21.1.2

Joseph, I. (2023). Teachers' Factors Influencing Adoption And Integration Of Information And Communication Technology Into Teaching And Learning. Emerging Educational Innovation, Creativity And Redrarch For Transformation Of Teaching And Learning In The New Global Realities'. Https://Www.Researchgate.Net/Publication/373171460_teachers

Juryatina, J., & Amrin, A. (2021). Students' interest in Arabic language learning: The roles of teacher. Journal of Educational Management and Instruction, 1(1), 40–49. https://doi.org/10.22515/jemin.v1i1.3459

Karacan, C. G., & Akoğlu, K. (2021). Educational augmented reality technology for language learning and teaching: A comprehensive review. Shanlax International Journal of Education, 9(2), 68–79. https://doi.org/10.34293/education.v9i2.3715

Khamisu Liman Takalafiya. (2023). The role of learner-focused instruction in teaching Arabic phonemic and phonological awareness: Enhancing language acquisition and proficiency.

British Journal of Multidisciplinary and Advanced Studies, 4(5), 112–118. https://doi.org/10.37745/bjmas.2022.0331

Kipli, M., & Khairani, A. Z. (2020). Content validity index: An application of validating CIPP instrument for programme evaluation. International Multidisciplinary Research Journal, 2(4), 31–40. https://doi.org/10.54476/iimrj313

Kropf, D. (2013). Connectivism: 21st century's new learning theory. https://files.eric.ed.gov/fulltext/EJ1017519.pdf

Legault, L. (2017). Self-determination theory. ResearchGate. https://www.researchgate.net/publication/317690916_Self-Determination_Theory

Mane, M. S. B. (2025). Teachers' readiness and the integration of technology in teaching. International Journal of Multidisciplinary and Current Educational Research, 7(3), 260–290. https://www.ijmcer.com/wp-content/uploads/2025/05/IJMCER_O0730260290.pdf

Marrahi Gomez, V., & Belda-Medina, J. (2023). The integration of augmented reality (AR) in education. Advances in Social Sciences Research Journal, 9(12), 475–487. https://doi.org/10.14738/assrj.912.13689

Maskor, Z. M., Baharudin, H., Lubis, M. A., & Yusuf, N. K. (2016). Teaching and learning Arabic vocabulary: From a teacher's experiences. Creative Education, 7(3), 482–490. https://doi.org/10.4236/ce.2016.73049

Mc, R., & Carmine, D. (2022). Using virtual reality to improve learning in children with ADHD. https://doi.org/10.35841/0971-9032.26.2.1244-1249

Md Enzai, N. I., Ahmad, N., Ab. Ghani, M. A. H., Rais, S. S., & Mohamed, S. (2021). Development of augmented reality (AR) for innovative teaching and learning in engineering education. Asian Journal of University Education, 16(4), 99. https://doi.org/10.24191/ajue.v16i4.11954

Mendoza-Ramírez, C. E., Tudon-Martinez, J. C., Félix-Herrán, L. C., Lozoya-Santos, J. de J., & Vargas-Martínez, A. (2023). Augmented reality: Survey. Applied Sciences, 13(18), 10491. https://doi.org/10.3390/app131810491

Muassomah, M., Hakim, A. R., & Salsabila, E. L. (2023). Arabic learning challenges. https://doi.org/10.2991/978-2-38476-002-2_45

Muid, A., & Aminah, A. (2025). Learning theory: Constructivism theories and the implications for Arabic language teaching. https://www.semanticscholar.org/paper/Learning-Theory%3A-Constructivism-Theories-and-The-Muid-Aminah/30243106c4e1a993d8c982f7e2c938ad138925a0

Muniandy, R., S.Kandasamy, S., Subramaniam, M., & Farashaiyan, A. (2022). An Investigation of Malaysian Secondary School Teachers and Students' Perspectives towards Computer Technology in Education during the Covid-19 Pandemic. Arab World English Journal, 2, 453–465. https://doi.org/10.24093/awej/covid2.30

Mus'ab, S., & Asbulah, L. H. (2023). Augmented reality technology in learning Arabic vocabulary from the perception of university students. International Journal of Interactive Mobile Technologies, 17(21), 79–96. https://doi.org/10.3991/ijim.v17i21.41277

Nihan, S. T. (2020). Karl Pearson's chi-square tests. Educational Research and Reviews, 15(9), 575–580.

Nikou, S. A. (2025). Motivation as a driver of engagement in augmented-reality learning in primary schools. TechTrends. https://doi.org/10.1007/s11528-025-01157-y

Nikou, S. A., Economides, A. A., & Perifanou, M. (2022). Teachers' views on integrating augmented reality in education: Needs, opportunities, challenges and recommendations. Future Internet, 15(1), 20. https://doi.org/10.3390/fi15010020

Nikou, S. A., Perifanou, M., & Economides, A. A. (2024). Exploring Teachers' Competences to Integrate Augmented Reality in Education: Results from an International Study. TechTrends. https://doi.org/10.1007/s11528-024-01014-4

Nur, & Asbulah, L. H. (2023). Higher education students' engagement and factors that constrain students' activeness in learning Arabic language. International Journal of Academic Research in Progressive Education and Development, 12(2). https://doi.org/10.6007/ijarped/v12-i2/17265

Parsons, V. L. (2017). Stratified sampling. ResearchGate. https://www.researchgate.net/publication/313793894_Stratified_Sampling

Pelila, J. R. O., Bag-Ongan, Q. F. L., Talania, J. L. P., & Wakat, G. S. (2022). Factors and barriers influencing technology integration in the classroom. Journal of Language Education and Educational Technology, 7(1), 1. https://doi.org/10.33772/jleet.v7i1.18704

Perifanou, M., Economides, A. A., & Nikou, S. A. (2022). Teachers' Views on Integrating Augmented Reality in Education: Needs, Opportunities, Challenges and Recommendations. Future Internet, 15(1), 20. https://doi.org/10.3390/fi15010020

Qadri, S. B., Mir, M. M., & Khan, M. A. (2023). Exploring the impact of augmented reality on customer experiences and attitudes: A comparative analysis with websites. International Journal of Management Research and Emerging Sciences, 13(2). https://doi.org/10.56536/ijmres.v13i2.421

Rababah, E. (2021). From theory to practice: Constructivist learning practices among Jordanian kindergarten teachers. ResearchGate; Birlesik Dunya Yenilik Arastirma ve Yayincilik Merkezi. https://www.researchgate.net/publication/351614491_From_theory_to_practice_Constructivist_learning_practices_among_Jordanian_kindergarten_teachers

Rahman, S. (2020). The advantages and disadvantages of using qualitative and quantitative approaches and methods in language "testing and assessment" research: A literature review. Journal of Education and Learning, 6(1), 102–112.

Rahmat, A. D., Kuswanto, H., Wilujeng, I., Ilma, A. Z., & Putranta, H. (2023). Teachers' perspectives toward using augmented reality technology in science learning. Cypriot Journal of Educational Sciences, 18(1), 215–227. https://doi.org/10.18844/cjes.v18i1.8191

Ramadhani, U. H., & Arifin, M. B. U. B. (2024). Augmented reality flashcards for Arabic vocabulary learning. Indonesian Journal of Islamic Studies, 12(2). https://doi.org/10.21070/ijis.v12i2.1756

Richter, A., Mohammadhossein, N., Richter, S., & Thatcher, J. (2025). Navigating augmented reality: Obstacles to use and tactics to overcome them. Business Horizons. https://doi.org/10.1016/j.bushor.2025.03.003

Roebianto, A., Savitri, I., Syaiful, I. A., & Adiyo, R. (2023). Content validity: Definition and procedure of content validation in psychological research. TPM - Testing. https://doi.org/10.4473/TPM30.1.1

Sahib, M. K., Mamat, A., & Adnan, M. A. M. (2020). Vocabulary learning strategies between learners of Arabic major and non-Arabic major at a Malaysia public university. GESJ: Education Science and Psychology, 91–92. https://www.researchgate.net/publication/353175365

Saleem, A., Kausar, H., & Deeba, F. (2021). Social constructivism: A new paradigm in teaching and learning environment. ResearchGate; The Women University Multan, Pakistan. https://www.researchgate.net/publication/358439655_Social_Constructivism_A_New_Paradigm_in_Teaching_and_Learning_Environment

Salim, M. S. (2024). Challenges and innovations in teaching the Arabic grammar to non-native speakers. Integrated Journal for Research in Arts and Humanities, 4(5), 136–147. https://doi.org/10.55544/ijrah.4.5.21

Santos, J. M., & Castro, R. D. R. (2021). Technological pedagogical content knowledge (TPACK) in action: Application of learning in the classroom by pre-service teachers (PST). Social Sciences & Humanities Open, 3(1), 1–8. https://doi.org/10.1016/j.ssaho.2021.100110

Sarip@Khalid, N. A., & Aziz, A. A. (2021). Technology integration in improving ESL learners' vocabulary: A systematic review. International Journal of Academic Research in Business and Social Sciences, 11(9). https://doi.org/10.6007/ijarbss/v11-i9/10896

Sarkar, B., & Chakraborty, S. (2024). Innovative teaching strategies for enhancing student engagement in the classroom. International Journal of Research Publication and Reviews, 5(7), 4893–4898.

Sarmento, R., & Costa, V. (2017). Descriptive analysis. ResearchGate. https://www.researchgate.net/publication/345213754_Descriptive_Analysis

Shah, K. R. (2019). Effective constructivist teaching learning in the classroom. https://files.eric.ed.gov/fulltext/ED598340.pdf

Shahrul Amri, R. Z., Kamin, Y., & Nor Hisyam. (2024). Integrating augmented reality with cognitive constructivist theory: A systematic review of enhancing… ResearchGate, 4(3 Special Issue), 124. https://doi.org/10.5281/zenodo.14048799

Sharma, S. (2019). Descriptive statistics. ResearchGate. https://www.researchgate.net/publication/333220406_Descriptive_Statistics

Shridhar, S. N., & Thippesh, K. (2023). Empowering students in the digital age: Assessing the digital empowerment level of students in higher education. International Journal of Advanced Academic Studies, 5(8), 41–44. https://doi.org/10.33545/27068919.2023.v5.i8a.1031

Sontay, G., & Karamustafaoğlu, O. (2021). Students' views on the use of augmented reality technology in teaching science. European Journal of Educational Sciences, 8(4), 1–14. https://doi.org/10.19044/ejes.v8no4a1

Sünger, İ., & Çankaya, S. (2019). Augmented reality: Historical development and area of usage. Journal of Educational Technology & Online Learning, 2(3). https://doi.org/10.31681/jetol.615499

Sırakaya, M., & Sırakaya, D. A. (2020). Augmented reality in STEM education: A systematic review. Interactive Learning Environments, 30(8), 1556–1569. https://doi.org/10.1080/10494820.2020.1722713

Surairi, M., Sr., Adam, M., Mukhlis, & Management Department, Universitas Syiah Kuala, Indonesia. (2025). The effect of perceived usefulness and perceived ease of use on technology usage and its impact on technology adoption of new PLN Mobile App: Study on PLN UP3 Banda Aceh office customer. International Journal of Scientific and Management Research, 8(2), 73–83. https://ijsmr.in/doc/ijsmr08_14.pdf

Talan, T., Yilmaz, Z. A., & Batdi, V. (2022). The effects of augmented reality applications on secondary students' academic achievement in science course. Journal of Education in Science, Environment and Health, 8, 333–347. https://doi.org/10.55549/jeseh.1193695

Techakosit, S., & Wannapiroon, P. (2015). Connectivism learning environment in augmented reality science laboratory to enhance scientific literacy. Procedia – Social and Behavioral Sciences, 174, 2108–2115. https://doi.org/10.1016/j.sbspro.2015.02.009

Titchiev, I., Caftanatov, O., & Talambuta, D. (2023). Challenges associated with using AR technology in education. Computer Science Journal of Moldova, 31(3), 367–380. https://doi.org/10.56415/csjm.v31.19

Tosto, C., Hasegawa, T., Mangina, E., Chifari, A., Treacy, R., Merlo, G., & Chiazzese, G. (2021). Exploring the effect of an augmented reality literacy programme for reading and spelling difficulties for children diagnosed with ADHD. Virtual Reality, 25(3), 879–894. https://doi.org/10.1007/s10055-020-00485-z

Tyson, M. (2021). Impact of augmented reality on vocabulary acquisition and retention. Issues and Trends in Learning Technologies, 9(1). https://files.eric.ed.gov/fulltext/EJ1444185.pdf

Ullah, O., & Iqbal, M. (2020). Students' conceptual understanding: Teaching methods as a hallmark. Global Regional Review, 5(1), 386–395. https://doi.org/10.31703/grr.2020(v-i).42

Umar, I. N., & Hassan, A. S. A. (2015). Malaysian Teachers' Levels of ICT Integration and Its Perceived Impact on Teaching and Learning. Procedia - Social and Behavioral Sciences, 197, 2015–2021. https://doi.org/10.1016/j.sbspro.2015.07.586

Vásquez-Carbonell, M. (2022). A systematic literature review of augmented reality in engineering education: Hardware, software, student motivation, and development recommendations. https://files.eric.ed.gov/fulltext/EJ1363194.pdf

Vouglanis, N. T. (2024). Teaching a foreign language through ICT to students with dyslexia and attention deficit hyperactivity disorder (ADHD) and the role of ICTs. GSC Advanced Research and Reviews, 21(1), 403–411. https://doi.org/10.30574/gscarr.2024.21.1.0394

Wan Daud, W. A. A., Abdul Ghani, M. T., Abdul Rahman, A., Mohamad Yusof, M. A. B., & Amiruddin, A. Z. (2021). ARabic-Kafa: Design and development of educational material for Arabic vocabulary with augmented reality technology. Journal of Language and Linguistic Studies, 17(4), 1760–1772. https://doi.org/10.52462/jlls.128

Wedyan, M., Elshaweesh, O., Alfalah, S. F. M., & Alazab, M. (2022). Augmented reality-based English language learning: Importance and state of the art. Electronics, 11(17), 2692. https://doi.org/10.3390/electronics11172692

Wei, C. Y., Kuah, Y. C., Ng, C. P., & Lau, W. K. (2021). Augmented reality (AR) as an enhancement teaching tool: Are educators ready for it? Contemporary Educational Technology, 13(3), ep303. https://doi.org/10.30935/cedtech/10866

Wild, F., Klemke, R., Lefrere, P., Fominykh, M., & Kuula, T. (2017). Technology acceptance of augmented reality and wearable technologies. In Communications in Computer and Information Science (pp. 129–141). Springer. https://doi.org/10.1007/978-3-319-60633-0_11

Winarso, W. (2016). Assessing the readiness of student learning activity and learning outcome. Jurnal Pencerahan, 10(2). https://doi.org/10.13170/jp.10.2.5246

Xue, L., Ghazali, N., & Mahat, J. (2025). Artificial intelligence (AI) adoption among teachers: A systematic review and agenda for future research. International Journal of Technology in Education, 8(3), 802–824. https://doi.org/10.46328/ijte.1191

Yaacob, N. A., Osman, M. M., & Bachok, S. (2015). An assessment of factors influencing parents' decision making when choosing a private school for their children: A case study

of Selangor, Malaysia. Procedia Environmental Sciences, 28, 406–417. https://doi.org/10.1016/j.proenv.2015.07.050

Yangambi, M. W. (2023). Impact of School Infrastructures on Students Learning and Performance: Case of Three Public Schools in a... ResearchGate; Scientific Research Publishing, Inc. https://www.researchgate.net/publication/370395131_Impact_of_School_Infrastructures_on_Students_Learning_and_Performance_Case_of_Three_Public_Schools_in_a_Developing_Country

Yan, S., & Adam, Z. (2018). Implementing Quizizz as game-based learning in the Arabic classroom. European Journal of Social Sciences Education, 5(1). https://oarep.usim.edu.my/jspui/bitstream/123456789/12802/1/Implementing%20Quizizz%20as%20Game%20Based%20Learning%20in%20the%20Arabic%20Classroom.pdf

Yasim, I. M. M., Lubis, M. A., Noor, Z. A. M., & Kamarudin, M. Y. (2016). The use of teaching aids in the teaching and learning of Arabic language vocabulary. Creative Education, 7(3), 443–448. https://doi.org/10.4236/ce.2016.73044

Yusoff, M. S. B. (2019). ABC of content validation and content validity index calculation. Education in Medicine Journal, 11(2), 49–54. https://doi.org/10.21315/eimj2019.11.2.6

Zai, F. (2023). The impact of vocabulary learning methods on students' vocabulary application skills. English Language Teaching and Linguistics Studies, 5(4), 206. https://doi.org/10.22158/eltls.v5n4p206

Zainuddin, N., Sahrir, M. S., Idrus, R. M., & Jaafar, M. N. (2016). Scaffolding a conceptual support for personalized Arabic vocabulary learning using augmented reality (AR) enhanced flashcards. Journal of Personalized Learning, 2(1), 95–103.

Zunita Mohamad Maskor, Baharudin, H., Lubis, M. A., & Yusuf, N. K. (2016). Teaching and learning Arabic vocabulary: From a teacher's experiences. Creative Education, 7(3), 482–490. https://doi.org/10.4236/ce.2016.73049

Zuo, R., Li, W., & Zhang, X. (2025). Augmented reality and student motivation: A systematic review (2013–2024). Journal of Computers for Science and Mathematics Learning, 2(1), 38–52. https://doi.org/10.70232/jcsml.v2i1.23