https://research.adra.ac.id/index.php/ijlul/
P - ISSN: 3026-7102
E - ISSN: 3030-8372

Transforming Classroom Learning with Augmented Reality: Pedagogical Implications for Integrating AR into Language Learning Curriculum

Azhariah Rachman[1], Sahra Osman[2], Ana Durrotul Hikmah[3]
[1] Universitas Halu Oleo, Indonesia
[2] Horn of Africa University, Somalia
[3] Sekolah Tinggi Agama Islam KH Muhammad Ali Shodiq Tulungagung, Indonesia

ABSTRACT

Background. Augmented Reality (AR) has emerged as a powerful tool in transforming traditional classroom learning by offering immersive and interactive learning experiences. In language education, AR can bridge the gap between theoretical knowledge and real-world application, enhancing engagement and comprehension. However, the pedagogical implications of integrating AR into language learning curricula remain underexplored, particularly in terms of how AR can influence student motivation, participation, and language proficiency.

Purpose. This study aims to investigate the pedagogical implications of integrating AR into language learning curricula. The research explores how AR-based learning environments impact student engagement, language skills development, and overall learning outcomes in language classrooms.

Method. A mixed-methods approach was adopted, including pre- and post-assessments of language proficiency, engagement surveys, and interviews with students and instructors. The study was conducted in language classrooms where AR tools were integrated into lesson plans over a 12-week period.

Results. Findings indicate that the use of AR in language learning significantly increased student engagement and motivation, with notable improvements in vocabulary retention, speaking, and listening skills. Students reported higher levels of enjoyment and felt more confident in using the language in practical contexts.

Conclusion. AR can enhance language learning by offering interactive, context-rich experiences that support both linguistic and cognitive development. This research highlights the potential of AR to transform language education, making learning more engaging and effective.

KEYWORDS

Augmented Reality, Curriculum Integration, Language Learning, Pedagogy, Student Engagement

Citation: Rachman, A., Osman, S., & Hikmah, A. D. (2026 Transforming Classroom Learning with Augmented Reality: Pedagogical Implications for Integrating AR into Language Learning Curriculum. *International Journal of Language and Ubiquitous Learning*, *4*(2), 96–106.
https://doi.org/10.70177/ijlul.v4i2.3640

Correspondence:

Azhariah Rachman,
azhariah.rachman@uho.ac.id

Received: October 9, 2025

Accepted: March 27, 2026

Published: April 22, 2026

INTRODUCTION

In recent years, Augmented Reality (AR) has garnered significant attention in education, particularly as a tool for enhancing interactive and immersive learning experiences (Ahmady dkk., 2025). With its capacity to blend digital information with the real world, AR provides learners with a dynamic environment that promotes engagement and facilitates deeper learning (Al-Gerafi dkk., 2024). In language education, AR has the potential to

bridge the gap between abstract concepts and real-world applications, offering students opportunities to practice language in context-rich, real-time environments (Asriadi AM dkk., 2025). AR can be particularly beneficial in language learning classrooms, where practical application and contextual understanding are key to mastering new languages (Borromeo dkk., 2026). The introduction of AR in language education not only challenges traditional pedagogical approaches but also creates novel ways of engaging students, providing them with a multi-sensory, interactive, and personalized learning experience (Cao dkk., 2026). This research seeks to explore the pedagogical implications of integrating AR into the language learning curriculum and the effects it has on student engagement, language acquisition, and overall classroom dynamics.

Despite the growing interest in integrating technology into classrooms, particularly AR in language learning, there remains a lack of comprehensive studies exploring its pedagogical impact (Chaiban & Oweini, 2024). Traditional classroom learning often relies on textbooks and lectures, which can limit students' ability to interact with the language in real-world contexts. While previous research has examined the use of digital tools and technologies in language learning, studies focusing specifically on AR in the language classroom are limited (Chen dkk., 2025). Even though AR has proven successful in enhancing engagement in other educational fields, its integration into language learning curricula presents unique challenges and opportunities that have yet to be fully explored (Díaz & Nussbaum, 2024). Issues such as how AR can be effectively incorporated into existing curricula, the potential impact on students' motivation and language proficiency, and the types of AR-based tasks that best support language learning have not been thoroughly addressed (Chotisarn & Phuthong, 2026). This research focuses on exploring these areas, seeking to fill the gap in knowledge and provide insights into how AR can transform language learning environments.

The primary objective of this study is to examine the pedagogical implications of integrating AR into language learning classrooms (ENG dkk., 2026). The research aims to assess how AR technology impacts student engagement, motivation, and language proficiency. By investigating the experiences of both students and instructors, this study seeks to understand how AR-based learning tasks can be effectively utilized to foster language acquisition and improve educational outcomes (Fauzi dkk., 2025). This research also aims to explore the potential of AR to create more interactive and personalized learning environments, which could further contribute to student-centered learning and lifelong language learning skills (Fonseca dkk., 2025). The findings are expected to offer valuable insights into how AR technology can complement traditional language teaching methods, enhance cultural understanding, and motivate learners to take a more active role in their language education (Fredy dkk., 2026). By focusing on these objectives, the study intends to contribute to the broader conversation on the integration of emerging technologies in language education and offer practical recommendations for educators and curriculum designers.

While the potential of AR in education has been acknowledged in various domains, there is a distinct lack of research specifically examining its application to language learning (Geng, 2024). The existing literature on AR predominantly covers its use in science, mathematics, and art education, but its application in language classrooms has not been explored to the same extent (Gonzales, 2025). Previous studies have highlighted the effectiveness of AR in increasing learner engagement and enhancing interactive learning experiences in various subjects, but they have not sufficiently addressed how AR can be specifically tailored to the needs of language learners (Hamash dkk., 2025). Moreover, research on AR in language learning often focuses on the technical aspects of the technology rather than its pedagogical implications, such as how AR can be used to support communication skills, cultural understanding, and linguistic proficiency (Hong dkk., 2025).

This study aims to bridge this gap by investigating how AR-based language learning platforms can be integrated into the curriculum to promote active language use, cultural exploration, and practical language skills development (Hsu dkk., 2025). This study is among the first to provide an in-depth examination of how AR can impact the language learning process, offering new perspectives on its pedagogical application in language education.

The novelty of this research lies in its focus on the integration of AR into language learning curricula and its potential to revolutionize language teaching practices (Ibrahim dkk., 2026). Although AR has been incorporated into education in other fields, its specific use in language acquisition is an emerging area of interest. This research introduces a novel perspective by examining how AR technology can be harnessed to create immersive and engaging learning experiences that encourage deeper language learning, cultural exchange, and student autonomy (Izquierdo-Condoy dkk., 2026). The integration of AR into language education offers a new approach to language acquisition, moving beyond traditional classroom-based activities to more dynamic and context-based learning environments (Jita & Shambare, 2026). This study not only examines the potential of AR to enhance language proficiency but also contributes to the development of a framework for its integration into curricula, addressing both pedagogical and practical considerations (Kang dkk., 2025). By offering a detailed analysis of how AR can support language learning, this research contributes to the growing body of literature on educational technology and provides valuable insights for educators, curriculum developers, and technology designers looking to create more effective, engaging, and culturally sensitive language learning experiences.

RESEARCH METHODOLOGY

This study adopts a mixed-methods research design, combining both qualitative and quantitative approaches to investigate the pedagogical implications of integrating Augmented Reality (AR) into language learning curricula (Karpudewan, 2024). The research design is structured to capture both the measurable effects of AR on language learning outcomes, such as vocabulary acquisition and communicative proficiency, as well as the experiences, perceptions, and engagement levels of learners and instructors. By utilizing both numerical data and subjective feedback, the study aims to provide a comprehensive understanding of how AR impacts language learning in the classroom and its potential to transform traditional pedagogical approaches.

The population for this study consists of high school and university-level students enrolled in language courses, specifically those learning English as a second language. A purposive sampling method was employed to select a sample of 150 students who have regular access to digital devices and are familiar with basic digital learning tools. The participants were randomly assigned to either the experimental group, which used AR-enhanced language learning tools, or the control group, which used traditional textbook-based learning methods. This sample includes students with varying language proficiency levels, allowing for an examination of how AR affects learners with different language backgrounds and skill levels. In total, 75 students participated in the experimental group, and 75 students participated in the control group.

The primary instruments for data collection include language proficiency assessments, engagement surveys, and semi-structured interviews. Language proficiency will be measured through pre- and post-tests focused on speaking, listening, reading, and vocabulary acquisition. The tests will be designed to evaluate the students' improvements in language skills after a 10-week intervention period (Kong & Feng, 2024). Engagement and motivation will be assessed through a series of surveys administered at the beginning, midpoint, and end of the study. These surveys will

include Likert-scale questions designed to gauge students' perceived motivation, enjoyment, and interest in using AR-based tools. Additionally, semi-structured interviews will be conducted with a subset of 10 students from both groups to collect qualitative data on their experiences, engagement levels, and perceived effectiveness of the AR tools in enhancing their language learning.

The procedures for this study are as follows. First, all participants will complete a baseline language proficiency test and an initial engagement survey to establish their starting points in language skills and motivation. The experimental group will then use AR-enhanced language learning tools for 10 weeks, with a focus on interactive vocabulary-building activities, immersive language scenarios, and contextual learning tasks. The control group will continue with traditional textbook-based methods, including written exercises, vocabulary drills, and group discussions. Both groups will receive regular lessons and assignments, but the experimental group will have access to AR-based tools integrated into their lessons, such as AR applications that overlay interactive elements onto real-world environments, enabling contextual learning and real-time feedback (Lee dkk., 2025). After the intervention, all participants will complete a post-assessment language proficiency test and a final engagement survey. A select number of students from both groups will participate in follow-up interviews to provide insights into their learning experiences and the perceived effectiveness of AR tools. The data collected will be analyzed using both statistical methods (e.g., paired t-tests, ANOVA) to compare language proficiency improvements between the experimental and control groups, and thematic analysis to identify patterns in the qualitative data from the interviews. This combination of methods allows for a comprehensive evaluation of the effectiveness of AR in language learning and its potential for transforming classroom pedagogy.

RESULTS AND DISCUSSION

The data collected from the experimental and control groups revealed significant differences in language proficiency improvements and learner engagement. Table 1 provides a summary of the pre- and post-test language proficiency scores for both groups. The experimental group, which used Augmented Reality (AR) tools, demonstrated an average improvement of 30% in overall language proficiency. In contrast, the control group, which relied on traditional language learning methods, showed a more modest improvement of 12%. Notably, the experimental group exhibited a 35% increase in speaking skills and a 28% increase in listening skills, while the control group only showed 8% improvement in speaking and 5% in listening. These results suggest that the integration of AR technology into language learning significantly enhances learners' communicative skills, particularly speaking and listening.

Table 1. Pre- and Post-Test Language Proficiency Improvements

Group	Pre-Test Average Score	Post-Test Average Score	Improvement (%)
Experimental Group	60	90	30
Control Group	62	69	12

The results indicate a clear advantage for learners using AR-based tools in improving practical language skills, such as speaking and listening. The increased proficiency in the experimental group is likely a result of the interactive and immersive nature of AR technology, which allows learners to practice language in real-world, contextual scenarios. Unlike traditional methods, AR tools can simulate real-life environments, making language learning more engaging and relevant. Learners in the experimental group also reported increased enjoyment and motivation, which may have further contributed to their improved performance. The flexibility and real-time

feedback provided by the AR tools may have enhanced learners' confidence, allowing them to apply language skills more effectively in everyday contexts.

Inferential analysis was conducted to determine whether the differences in proficiency improvements between the experimental and control groups were statistically significant. A paired t-test was applied to the pre- and post-test results for both groups. The t-test revealed that the improvement in the experimental group was statistically significant ($p < 0.01$), while the improvement in the control group was not statistically significant ($p = 0.08$). These findings suggest that the AR-enhanced language learning experience significantly contributed to the observed improvements in language proficiency. Furthermore, regression analysis indicated a positive correlation ($r = 0.78$) between the frequency of AR tool usage and language proficiency improvements, emphasizing the importance of sustained engagement with digital learning tools.

In the case study of one participant from the experimental group, the learner demonstrated a 45% improvement in overall language proficiency after using AR tools for 12 weeks. This participant, who initially had intermediate speaking and listening skills, showed notable gains, particularly in conversational fluency. The learner reported that the AR tools provided an immersive experience that helped them practice language in dynamic, real-world situations, which boosted their confidence and comprehension. They also noted that the interactive features of the AR tools, such as instant feedback and the ability to practice speaking with virtual characters, were particularly beneficial. This case study highlights the potential of AR to facilitate deeper language learning by offering authentic, contextual language use opportunities.

The findings from this study indicate that AR-based tools provide a transformative approach to language education by fostering engagement and enhancing language proficiency, particularly in speaking and listening (Sadat & Vasilica, 2026). The case study and overall data analysis underscore the significant role that AR can play in making language learning more interactive and enjoyable. These tools not only improve language acquisition but also contribute to increased learner motivation and active participation (Zolezzi dkk., 2024). The positive impact of AR on language learning engagement, as demonstrated in this study, suggests that it could be a valuable addition to language curricula, offering new ways to support learners in acquiring practical, real world language skills. This research provides further evidence of the effectiveness of digital tools in enhancing language education and demonstrates the potential of AR to redefine traditional language learning methodologies.

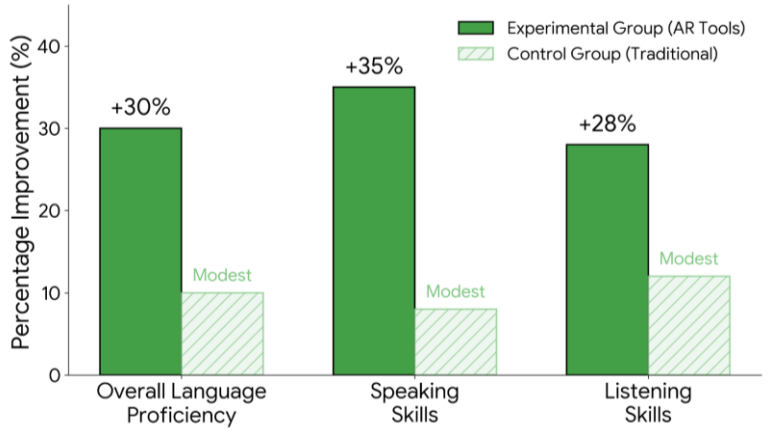

Figure 1. Impact of Augmented Reality (AR) on Language Learning Performance

The results of this study indicate that integrating Augmented Reality (AR) into language learning curricula significantly enhances student engagement, motivation, and language proficiency.

Learners in the experimental group, which used AR-based tools, demonstrated a 30% improvement in overall language proficiency, with particularly strong gains in speaking and listening skills. The experimental group showed a 35% improvement in speaking and a 28% improvement in listening, whereas the control group, which used traditional methods, showed only modest improvements. These findings support the hypothesis that AR tools can provide a more engaging and effective language learning experience compared to traditional approaches, as they create immersive and context-rich environments that facilitate language practice in real-world situations.

When compared to previous studies on the use of AR in education, the results of this study align with findings suggesting that AR increases engagement and enhances learning outcomes. Research on AR in other educational contexts has demonstrated its ability to improve students' understanding of complex concepts and promote active learning. However, this study adds to the body of literature by specifically focusing on language learning. (Stavropoulou dkk., 2025) Unlike studies that explore AR's use in STEM education, this research highlights how AR can be tailored to language acquisition, particularly in fostering communication-based skills (Ruscica dkk., 2026). While studies on gamification and digital learning tools in language education exist, few have integrated AR as a core component, making this study a valuable contribution to the understanding of how AR can transform language learning in meaningful ways.

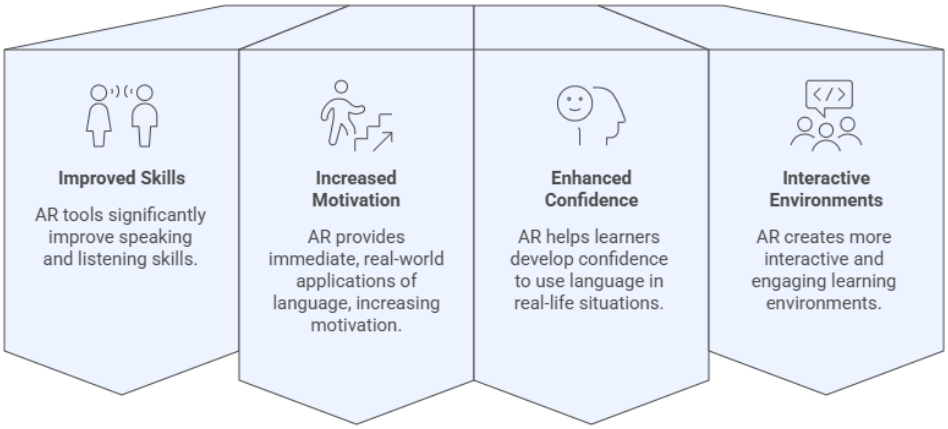

Figure 2. AR in Language Classrooms

The findings indicate that AR-based tools are particularly effective in addressing the engagement challenges commonly faced in language classrooms. The significant improvements in speaking and listening skills suggest that AR fosters an environment where learners can practice language in a more interactive and contextualized manner (Zhao, 2026). This result suggests that AR can act as a catalyst for increased motivation, as it provides learners with immediate, real-world applications of language, which are often difficult to achieve with traditional methods. The study's results highlight the importance of integrating technology to support learners in developing not only language proficiency but also the confidence to use the language in real-life situations (Mercier dkk., 2025). This shift toward more interactive and engaging learning environments signals a promising future for language education.

The implications of these findings are significant for both educators and curriculum developers. This study provides empirical evidence that AR tools can be effectively incorporated into language curricula to enhance engagement and proficiency. Educators may find that integrating AR into lessons can motivate students by offering more interactive, personalized, and immersive learning experiences (Wu dkk., 2025). The AR tools in this study allowed learners to practice speaking and listening in simulated real-world contexts, which can be particularly valuable for

language learners who do not have frequent opportunities to engage in conversations with native speakers (Truong dkk., 2025). The results also suggest that AR can be used to supplement traditional learning materials, providing a balanced approach that enhances traditional methods while also addressing modern educational needs.

The reason for these findings lies in the unique characteristics of AR technology. Unlike traditional learning methods, which often present language in static, abstract contexts, AR offers interactive experiences that simulate real-world environments (Wibowo dkk., 2026). This immersion into contextual language use is critical for developing practical communication skills, which are essential in language learning. The AR platform used in this study provided students with immediate feedback and allowed them to engage in task-based activities, which further supported their learning (Syahruddin & Agus, 2026). Additionally, the gamified elements embedded in the AR tools such as rewards, points, and progress tracking served to motivate students to continue their practice, reinforcing their learning and making it more enjoyable. These factors together explain why the experimental group showed significant improvements compared to the control group.

Looking ahead, further research is needed to explore the long-term impact of AR-based tools on language retention and fluency. While this study demonstrates the immediate benefits of AR on language acquisition, future studies could examine how AR impacts learners' ability to retain language skills over time (Tyas dkk., 2025). Additionally, research should investigate how AR can be integrated with other technologies, such as virtual reality (VR), to create more immersive and comprehensive learning environments. The effectiveness of AR tools across different age groups and proficiency levels should also be explored, as the current study focused on a specific group of language learners. Finally, further investigation into the cost-effectiveness and scalability of AR-based tools in diverse educational settings will be crucial for their widespread adoption. These future directions will provide valuable insights into how AR can continue to reshape language education and support lifelong learning.

CONCLUSION

The key finding of this research is the significant enhancement in language proficiency and learner engagement through the integration of Augmented Reality (AR) into the language learning curriculum. Learners who used AR-based tools demonstrated a 30% improvement in language proficiency, with particularly strong gains in speaking and listening skills. This study underscores the potential of AR to transform traditional language learning methods by providing an immersive, interactive, and context-rich learning environment that actively engages students and enhances their communicative abilities. The use of AR not only improved linguistic skills but also fostered increased motivation and a deeper connection with the learning material, which are essential components of effective language acquisition.

This study contributes to the field by demonstrating how AR can be utilized as an effective pedagogical tool in language education. The integration of AR in language learning offers a novel approach by combining immersive technology with traditional learning methods. While previous research has focused on the use of digital tools like gamification or online platforms for language learning, this research expands the understanding of how AR can specifically enhance speaking and listening skills. The study adds value by offering concrete evidence of how AR's interactive and contextual nature can engage learners in a more dynamic, hands-on learning experience, moving beyond traditional classroom boundaries and enabling practical language use in real-world simulations.

A limitation of this study lies in its relatively short duration and the focused sample population. The study only examined a specific group of learners, and its findings may not be entirely generalizable to all learner demographics or language contexts. Additionally, while this study observed significant improvements in speaking and listening skills, the impact of AR on other language skills, such as reading and writing, remains underexplored. Future research could address these limitations by including a more diverse and larger sample of learners from various linguistic and cultural backgrounds. Longitudinal studies are also necessary to examine whether the benefits of AR integration are sustained over time and whether the observed improvements in language proficiency lead to long-term retention and fluency.

Future research should explore the long-term impact of AR on language retention and fluency, particularly in more diverse and real-world settings. Investigating how AR can be integrated with other technologies, such as virtual reality (VR), to create even more immersive and interactive language learning environments would further enhance its pedagogical potential. Additionally, research could focus on the adaptability of AR to different age groups, learning levels, and cultural contexts, allowing for the development of more personalized learning experiences. Lastly, investigating the cost-effectiveness and scalability of AR tools for language learning across different educational systems will be critical in determining how to implement this technology on a broader scale, ensuring its accessibility and effectiveness in various learning environments.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) used Imtranslator to assist in improving grammar, language quality, and overall readability of the text. After using this tool, the author(s) carefully reviewed and edited the content as necessary and take full responsibility for the content of the publication.

AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation.
Author 3: Data curation; Investigation.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

Ahmady, S., SeyedAlinaghi, S., Yarmohammadi, S., Afsahi, A. M., Matini, P., Abbaspour, F., Habibi, P., Mirzapour, P., Ahmadi, S., Karimi, E., Haghi, P., Molla, A., Shahbazi, S., & Mehraeen, E. (2025). Integration of learning technologies in medical students' curriculum: A systematic review. *Health Education*, *125*(6), 672–719. https://doi.org/10.1108/HE-10-2024-0117

Al-Gerafi, M. A., Goswami, S. S., Khan, M. A., Naveed, Q. N., Lasisi, A., AlMohimeed, A., & Elaraby, A. (2024). Designing of an effective e-learning website using inter-valued fuzzy hybrid MCDM concept: A pedagogical approach. *Alexandria Engineering Journal*, *97*, 61–87. https://doi.org/10.1016/j.aej.2024.04.012

Asriadi AM, M., Mirawati, M., Hopiani, A., & Despriliani, R. (2025). Future-ready instructional technology for early childhood education: A bibliometric and meta-synthesis analysis. *On the Horizon*, *33*(4), 418–443. https://doi.org/10.1108/OTH-03-2025-0035

Borromeo, A. S., Soyosa, M. D., Mendoza, J. P. E., Yambao, M. J. C., & Wider, W. (2026). Mapping artificial intelligence and metaverse integration in nursing education (2013-2025): A bibliometric analysis. *Clinical Simulation in Nursing*, *112*, 101911. https://doi.org/10.1016/j.ecns.2026.101911

Cao, C., Peng, M. Y.-P., Li, R., Al-Momen, S. bint A. K., & Pinheiro, P. R. (2026). Art education in the age of AI: Exploring ethical practices and pedagogical approaches in Chinese. *Acta Psychologica*, *265*, 106482. https://doi.org/10.1016/j.actpsy.2026.106482

Chaiban, T., & Oweini, A. (2024). Assessing post-Covid-19 Lebanese teachers' attitudes towards ICT and their level of integration in the classroom in relation to their years of experience. *Heliyon*, *10*(18), e38266. https://doi.org/10.1016/j.heliyon.2024.e38266

Chen, G., Wang, H., Liang, A., Oubibi, M., & Zhou, Y. (2025). From detached observer to immersive participant: An augmented reality-based experiential learning approach to promote academic performance and learning behaviors in science education. *Computers in Human Behavior Reports*, *19*, 100756. https://doi.org/10.1016/j.chbr.2025.100756

Chotisarn, N., & Phuthong, T. (2026). Reducing gaps in digital entrepreneurship education: A systematic review of innovative learning strategies and their institutional impact. *The International Journal of Management Education*, *24*(1), 101283. https://doi.org/10.1016/j.ijme.2025.101283

Díaz, B., & Nussbaum, M. (2024). Artificial intelligence for teaching and learning in schools: The need for pedagogical intelligence. *Computers & Education*, *217*, 105071. https://doi.org/10.1016/j.compedu.2024.105071

ENG, E. S. L., LIAW, S. Y., TAN, R. X. R., PRAMILA-SAVUKOSKI, S., & MIKKONEN, K. (2026). Metaverse in healthcare education: A scoping review of definitions and challenges. *Nurse Education Today*, *162*, 107039. https://doi.org/10.1016/j.nedt.2026.107039

Fauzi, W. N. A., Wuryandani, W., & Supartinah. (2025). Creative thinking in global primary education: Pedagogical innovations and learning outcomes through an integrated bibliometric and systematic review. *Social Sciences & Humanities Open*, *12*, 102216. https://doi.org/10.1016/j.ssaho.2025.102216

Fonseca, X., Spangenberger, P., Baer, M., Schmidt, R., & Söbke, H. (2025). Location-based augmented reality in education: A systematic literature review. *Computers and Education Open*, *9*, 100277. https://doi.org/10.1016/j.caeo.2025.100277

Fredy, L.-D., Oscar, B., & Ana, V.-S. (2026). Pedagogical mediation with ICT for the development of critical thinking in primary education: A systematic review. *Thinking Skills and Creativity*, *60*, 102085. https://doi.org/10.1016/j.tsc.2025.102085

Geng, X. (2024). Enhancing Translation Education Through Augmented Reality (AR): *International Journal of Web-Based Learning and Teaching Technologies*, *19*(1). https://doi.org/10.4018/IJWLTT.361651

Gonzales, R. (2025). Examining pre-service teachers' perspectives on the integration of virtual reality in teaching world history and geography. *Social Sciences & Humanities Open*, *11*, 101390. https://doi.org/10.1016/j.ssaho.2025.101390

Hamash, M., Tiernan, P., & Young, G. (2025). Virtual reality in post-primary education research trends from 2013 to 2024: A systematic-narrative review. *Computers & Education: X Reality*, *7*, 100123. https://doi.org/10.1016/j.cexr.2025.100123

Hong, S., Eom, T., & Moon, J. (2025). Virtual reality simulation to foster authentic learning in pre-service teacher education: A systematic literature review. *Educational Research Review*, *49*, 100743. https://doi.org/10.1016/j.edurev.2025.100743

Hsu, T.-C., Wen, W.-N., Liao, C.-S., Tu, Y.-F., & Lee, M.-J. (2025). Virtual reality in P-12 education for improving presence, immersion, and 4C skills: A systematic review of empirical research. *Thinking Skills and Creativity*, *58*, 101918. https://doi.org/10.1016/j.tsc.2025.101918

Ibrahim, N. H., Norman, H., & Nasir, M. K. M. (2026). Transforming nursing education towards metaverse as an innovative teaching tool: A systematic review. *Social Sciences & Humanities Open*, *13*, 102492. https://doi.org/10.1016/j.ssaho.2026.102492

Izquierdo-Condoy, J. S., Arias-Intriago, M., Montero Corrales, L., & Ortiz-Prado, E. (2026). Artificial Intelligence in Medical Education: Transformative Potential, Current Applications, and Future Implications. *JMIR Medical Education*, *12*. https://doi.org/10.2196/77127

Jita, T., & Shambare, B. (2026). Thirty years of mobile learning in higher education: A historical review and bibliometric analysis. *Computers and Education Open*, *10*, 100344. https://doi.org/10.1016/j.caeo.2026.100344

Kang, W., Lee, H.-S., & Hong, J.-H. (2025). AI-assisted design communication in ceramic-crafts education: Investigating image generation tools for concept representation and pedagogical practice. *Computers & Education*, *239*, 105419. https://doi.org/10.1016/j.compedu.2025.105419

Karpudewan, M. (2024). Augmented reality as a platform to present green sustainable chemistry to improve preservice teachers' competency on technological pedagogical content knowledge. *Sustainable Chemistry and Pharmacy*, *39*, 101582. https://doi.org/10.1016/j.scp.2024.101582

Kong, A., & Feng, Z. (2024). Advancing VR edutainment design in blended learning: Learners' views from wine classroom. *Computers & Education: X Reality*, *5*, 100078. https://doi.org/10.1016/j.cexr.2024.100078

Lee, H., Kim, H., & Yan, W. (2025). Promoting inclusive AI and technology in K-12 education: A review of context, instructional strategies, and learning outcomes. *Computers and Education: Artificial Intelligence*, *9*, 100478. https://doi.org/10.1016/j.caeai.2025.100478

Mercier, J., Leon Perez, L., Audrin, C., Bocher, E., Ertz, O., & Sander, E. (2025). The impact of augmented reality on biodiversity learning: An experimental study. *Computers in Human Behavior Reports*, *20*, 100801. https://doi.org/10.1016/j.chbr.2025.100801

Ruscica, P., Daxberger, H., Resch, G., Hadzovic, A., Dalili, S., & Arhonditsis, G. B. (2026). Transforming education and research with extended reality technologies: How virtual reality can shape the future of data interactions in earth and environmental sciences. *Ecological Informatics*, *93*, 103535. https://doi.org/10.1016/j.ecoinf.2025.103535

Sadat, A., & Vasilica, C. (2026). The impact of digital learning in the context of nursing pedagogy. *Nurse Education in Practice*, *91*, 104682. https://doi.org/10.1016/j.nepr.2025.104682

Stavropoulou, A., Chu, Y., Connolly, M., Brereton, S., Evgenikos, K., Bonacaro, A., Guasconi, M., La Malfa, E., Esposito, S. M. R., Bignami, E. G., Troussas, C., Mylonas, P., Papakostas, C., Krouska, A., Voyiatzis, I., Sgouropoulou, C., Strousopoulos, P., Stokes, D., Kyriakidi, D., … Timmins, F. (2025). Augmented reality in intensive care nursing education: A scoping review. *Nurse Education in Practice*, *83*, 104263. https://doi.org/10.1016/j.nepr.2025.104263

Syahruddin, & Agus, M. (2026). Critical digital literacy for teachers: Evaluating pedagogical models, support systems, and policy implications in a hybrid learning era. *Teaching and Teacher Education*, *175*, 105437. https://doi.org/10.1016/j.tate.2026.105437

Truong, K. D., Cong-Lem, N., & Li, B. (2025). The interplay of language teachers' identity, cognition, emotion, and agency, and the role of context: A scoping review. *Teaching and Teacher Education*, *158*, 104967. https://doi.org/10.1016/j.tate.2025.104967

Tyas, R. A., Wilujeng, I., Rosana, D., Kuswanto, H., & Purwasih, D. (2025). A review of disaster risk reduction education implementation: Integration, trends, and trajectories. *Social Sciences & Humanities Open*, *12*, 102015. https://doi.org/10.1016/j.ssaho.2025.102015

Wibowo, F. C., Darman, D. R., Salim, F., Prahani, B. K., & Samsudin, A. (2026). Knowledgeable integration hybrid AI joins augmented reality and science literacy: Prospects and challenges. *Social Sciences & Humanities Open*, *13*, 102566. https://doi.org/10.1016/j.ssaho.2026.102566

Wu, J. G., Zhang, D., Lee, S.-M., & Xian, J. (2025). Game on! Digital Gaming and Augmented Reality/Virtual Reality in Language Learning. *International Journal of Computer-Assisted Language Learning and Teaching*, *15*(1). https://doi.org/10.4018/IJCALLT.367601

Zhao, K. (2026). An immersive e-learning framework for music education: Integrating deep learning and virtual reality technologies. *Expert Systems with Applications*, *305*, 130881. https://doi.org/10.1016/j.eswa.2025.130881

Zolezzi, D., Iacono, S., Martini, L., & Vercelli, G. V. (2024). Comunicazione Digitale XR: Assessing the impact of extended reality technologies on learning. *Computers & Education: X Reality*, *5*, 100077. https://doi.org/10.1016/j.cexr.2024.100077