Proceedings of International Conference on Islamic Education (ICIED)
Building an Inclusive and Sustainable Educational System
Volume 11, 2026 (p-ISSN 2477-3638 / e-ISSN 2613-9804)

AI-assisted arabic language learning in Southeast Asia: Digital literacy and intercultural communicative competence

Azizatul Munawaroh[1], Azkia Ni'matul Maula [2]

Correspondence:
azizatulmunawaroh95@gmail.com

Affiliation:
Master's Program in Arabic Language Education, Graduate School, Universitas Islam Negeri Maulana Malik Ibrahim Malang, Indonesia[1]
azizatulmunawaroh95@gmail.com

Master's Program in Arabic Language Education, Graduate School, Universitas Islam Negeri Maulana Malik Ibrahim Malang, Indonesia[2]
azkianikmatulmaula03@gmail.com

Abstract
This study explores AI-assisted Arabic language learning in five selected Southeast Asian contexts: Indonesia, Malaysia, Brunei Darussalam, Southern Thailand, and Singapore, focusing on AI implementation, digital and AI literacy, and intercultural communicative competence (ICC) from an Islamic Education perspective. A qualitative cross-context exploratory design was employed. Data were collected through semi-structured interviews with 12 participants, comprising three lecturers, six Arabic language teachers, and three university students, and supplemented by documentary analysis. Data were analyzed through data condensation, data display, conclusion drawing and verification, and thematic cross-context analysis. The exploratory findings indicate that AI adoption is shaped by educational ecosystem readiness, particularly digital infrastructure, institutional support, policies, and educator competencies. Three emerging modes of AI adoption were identified: AI as a tool supporting educators' activities, AI as part of institutional learning systems, and AI as part of adaptive, data-driven learning ecosystems. AI also supports digital and AI literacy by encouraging users to search, evaluate, verify, and responsibly use AI-generated information, while providing opportunities to explore culturally situated language use and communication. From an Islamic Education perspective, these practices highlight the importance of critical evaluation, responsible technology use, and respectful engagement with cultural diversity. The study contributes an integrated perspective linking AI adoption, digital and AI literacy, and ICC in Arabic language education while emphasizing the role of educational ecosystem readiness and ethical pedagogical guidance.

Keywords:
Artificial Intelligence; Arabic Language Learning; Digital Literacy; Intercultural Communicative Competence; Southeast Asia

A. INTRODUCTION

The growing digitalization of education has increasingly integrated artificial intelligence (AI) into language learning through intelligent tutoring systems, conversational tools, automated assessment, and generative technologies. These applications can support adaptive learning, real-time feedback, conversational practice, speech recognition, and automated translation, while enhancing learners' motivation, engagement, autonomy, and communicative competence (Crompton & Burke, 2023; Kasneci et al., 2023; Kristiawan et al., 2024; Lee et al., 2026; UNESCO, 2024a; Zhu & Wang, 2025). However, the benefits of AI depend not only on

technological capabilities but also on learners' ability to critically, ethically, and responsibly evaluate AI-generated information (Yan et al., 2023; Zhang et al., 2024). Thus, AI-assisted language learning should be examined beyond linguistic outcomes to include the competencies needed to navigate digital environments.

In Arabic language learning, AI technologies such as chatbots, speech recognition, intelligent tutoring systems, automated translation, and generative AI have been applied to support various language skills (Samiya, 2025). Advances in large language models and Arabic natural language processing have also created opportunities for more authentic and responsive learning environments (Alayba, 2025; Qian et al., 2024). However, existing research has largely focused on language outcomes and technological effectiveness, while less attention has been given to how learners critically evaluate AI outputs and use AI in digitally mediated and culturally diverse contexts.

This issue highlights the importance of digital literacy and AI literacy in AI-supported learning. Digital literacy involves the ability to search, evaluate, produce, and apply digital information critically, ethically, and responsibly, whereas AI literacy involves understanding AI systems, evaluating their outputs, and recognizing their social and ethical implications (Dringó-Horváth et al., 2025; Stolpe & Hallström, 2024; Tadimalla & Maher, 2024; UNESCO, 2024b). AI-supported learning can foster these competencies through information seeking, content evaluation, digital collaboration, and technology-based problem solving (Xiao et al., 2024). At the same time, Arabic language learning is closely connected to intercultural communicative competence (ICC), as language use involves cultural values, perspectives, and practices. AI can support ICC through authentic resources, conversational simulations, and multilingual interactions that expose learners to diverse cultural perspectives (Dai & Hua, 2025; Deardorff, 2020; Klimova & Chen, 2024; Xia et al., 2024).

From the perspective of Islamic Education, AI-assisted language learning also requires ethical and pedagogical consideration. The integration of AI in Islamic education should remain aligned with educational values, ethical responsibility, and pedagogical principles rather than being treated merely as a technological innovation (Hady et al., 2025; Khoiruddin & Dzulkifli, 2026). Islamic Education therefore provides a lens for understanding AI use beyond technological competence by emphasizing responsible engagement with knowledge, critical evaluation of information, responsible technology use, and the preservation of human and cultural dimensions in learning. These considerations are particularly relevant to Arabic language learning, where language is closely connected with cultural meanings, social interaction, and the responsible use of digitally generated knowledge.

These issues are particularly relevant in Southeast Asia, where Arabic language education develops within diverse multilingual and multicultural educational contexts. Indonesia, Malaysia, Brunei Darussalam, Southern Thailand, and Singapore differ in educational characteristics and technology adoption, providing diverse contexts for examining AI-assisted Arabic learning. Nevertheless, research has largely focused on individual national contexts and linguistic outcomes, while comparative research examining AI implementation, digital literacy, and ICC in Arabic language education remains limited (Chen & Wei, 2025; Joseph et al., 2024; Liu, 2025; Yang et al., 2025).

To address this gap, this study examines AI-assisted Arabic language learning across five selected Southeast Asian contexts Indonesia, Malaysia, Brunei Darussalam, Southern Thailand, and Singapore. It focuses on how educational contexts shape AI implementation and its contribution to digital literacy and ICC, while interpreting the emerging patterns through an Islamic Education perspective. Through this cross-context exploratory approach, the study integrates technological implementation, digital and AI literacy, ICC, and Islamic Education as an ethical and pedagogical lens to provide a more nuanced understanding of AI-assisted Arabic language learning and broader competency development in selected Southeast Asian educational contexts.

B. METHODS

This study employed a qualitative cross-context exploratory design to examine AI-assisted Arabic language learning in five selected Southeast Asian contexts: Indonesia, Malaysia, Southern Thailand, Brunei Darussalam, and Singapore. The study focused on AI implementation, digital and AI literacy, and intercultural communicative competence (ICC), with Islamic Education serving as an ethical and pedagogical lens for interpreting responsible knowledge engagement, critical evaluation of AI-generated information, responsible technology use, and culturally appropriate communication. The study aimed to identify exploratory patterns rather than generalize findings to national educational systems. Twelve participants were purposively selected based on their direct involvement in teaching or learning Arabic using AI-supported tools. They consisted of three lecturers, six Arabic language teachers, and three university students, distributed across Indonesia (3), Malaysia (3), Southern Thailand (2), Brunei Darussalam (3), and Singapore (1). Participants were anonymized using contextual codes: IN, MY, TH, BR, and SG. Given the small and uneven distribution, the findings are interpreted as exploratory patterns within the selected contexts.

Data were collected in November 2025 through semi-structured interviews and documentary analysis. Interviews were conducted online and offline, lasted approximately 45 minutes per participant, and explored experiences, practices, benefits, challenges, and educational contexts of AI-assisted Arabic learning. Documentary data included lesson plans, scholarly articles, photographs, and videos. The data were analyzed using the interactive model of Miles et al. (2019), comprising data condensation, data display, and conclusion drawing and verification, supplemented by thematic and cross-context analysis. Interview and documentary data were coded and compared to identify recurring practices and issues related to AI use, digital and AI literacy, ICC, educational context, and challenges. The analysis generated three exploratory modes of AI adoption: AI as a tool supporting educators' activities, AI as part of an institutional learning system, and AI as part of an adaptive, data-driven learning ecosystem. These modes emerged from recurring patterns in the data rather than predetermined national classifications. Trustworthiness was supported through methodological and source triangulation across interviews, documents, lecturers, teachers, and students. The researchers maintained systematic links between data, codes, categories, and themes, while participant identities were protected through anonymized codes.

C. RESULT & DISCUSSION

AI Implementation in Arabic Language Learning in Selected Southeast Asian Contexts

The findings reveal variation in the implementation of AI-assisted Arabic language learning across the five selected contexts. This variation is associated with differences in digital infrastructure, institutional support, digitalization policies, and educators' preparedness to use technology. Across the contexts, AI was used for material development, learning activities and assessment, translation, media development, and access to digital learning resources. However, the level and form of integration varied according to the readiness of the educational ecosystem in each context. A comparison of these contexts is presented in Table 1.

Tabel 1. Digital Infrastructure and Ecosystem Readiness for AI Implementation in Arabic Language Learning

Country/ Context	Digital Infrastructure	Institutional/ Ecosystem Support	Observed AI Integration	Key Challenges	Evidence Basis
Indonesia	Internet, LMS, and digital devices with uneven access	Growing digital learning support	Educator support and learning activities	Infrastructure and teacher digital literacy	Interviews: IN-1–IN-3; documentary data

Building an Inclusive and Sustainable Educational System

Southern Thailand	Internet and classroom TVs; limited smartboards	Digital teacher training and school-level support	Learning support	Institutional policies and facilities	Interviews: TH-1–TH-2; documentary data
Malaysia	LMS and digital devices	Support from formal institutions	Institutional learning systems	Formal–migrant school disparity	Interviews: MY-1–MY-3; documentary data
Brunei Darussalam	Smart TVs, Wi-Fi, and LMS	Government and institutional support	Institutional learning systems	Curriculum integration	Interviews: BR-1–BR-3; documentary data
Singapore	SLS, ALS, and high-speed internet	Strong digitalization policies and ecosystem support	Adaptive and data-driven learning	Governance and ethical considerations	Interview: SG-1; documentary data

Source: Interview and documentary data, 2025

The comparison presented in Table 1 indicates that the availability of digital technology alone does not determine the level of AI integration. In Indonesia, AI was primarily used to support educators' activities, including material development, learning exercises, translation, and media development. Participants also identified limitations related to educators' digital competence and uneven infrastructure. One participant noted, "*not all teachers were able to use digital media effectively and that internet access and infrastructure remained inadequate in some areas*" (IN-2, interview, November 26, 2025). This suggests that access to technology does not automatically result in systematic AI integration into teaching and learning.

A comparable pattern was observed in Southern Thailand, where available infrastructure was relatively supportive but the use of digital devices remained influenced by school policies and facility limitations. An Arabic language teacher explained, *"the use of mobile phones and other digital devices depended on school policies, meaning that not all classes could fully utilize available technologies"* (TH-1, interview, November 21, 2025). Thus, institutional rules, in addition to technological access, influenced how AI-supported learning could be implemented. In Malaysia, AI-supported learning showed a more systematic connection with formal institutional learning systems through the use of LMS and digital devices. However, the evidence also indicates disparities between institutions, particularly in migrant community schools with limited digital infrastructure. One participant reported that access to an LMS was restricted by limited facilities and network connectivity (MY-2, interview, November 22, 2025). This finding suggests that variation in AI implementation may occur not only between selected contexts but also among institutions within the same context.

Brunei Darussalam showed stronger institutional support through the availability of LMS, digital devices, and policies supporting the digitalization of learning. Within this context, AI was observed as moving beyond a learning support tool toward greater integration within institutional learning systems. Singapore demonstrated a more comprehensive pattern through the use of SLS (*Student Learning Space*), ALS (*Adaptive Learning System*), and other digital platforms that support learning personalization, feedback, and monitoring of learning progress. These patterns indicate that stronger institutional support and digital infrastructure can create greater opportunities for systematic AI integration.

Across the five selected contexts, the findings suggest three emerging modes of AI adoption rather than fixed country-level classifications. The first is AI as a tool supporting educators' activities, characterized by the use of AI for material development, learning exercises, translation, and assessment. This pattern was more evident in the Indonesian and Southern Thai contexts. The second is AI as part of an institutional learning system, characterized by integration with LMS platforms, digital assessment, and digital learning resources, as observed more prominently in the Malaysian and Bruneian contexts. The third is AI as part of an adaptive, data-driven learning ecosystem, characterized by personalization, feedback, and monitoring of learning progress, as observed most clearly in the Singaporean context.

Building an Inclusive and Sustainable Educational System

These emerging modes indicate that AI implementation is more closely associated with the readiness of the educational ecosystem than with the mere availability of AI applications or digital devices. Infrastructure, institutional and policy support, educators' competencies, and access to technology shape the extent to which AI can be integrated strategically and sustainably. This finding is consistent with previous studies emphasizing the importance of user readiness, digital competence, and educational environments for effective and responsible AI use (Kasneci et al., 2023; UNESCO, 2024b; Yan et al., 2023). The present findings further suggest that, within the selected Arabic language learning contexts, the form of AI integration reflects differences in the maturity and support structures of the surrounding learning ecosystem.

AI Contributions to Digital Literacy

Across the selected contexts, AI use reshaped digital literacy practices by changing how teachers and learners searched for, evaluated, verified, and applied information in Arabic language learning. Rather than functioning only as a source of readily available information, AI required users to examine the reliability of generated outputs, recognize system limitations, and make informed decisions about their use. This finding reflects the broader understanding of digital literacy as the ability to manage digital information critically, ethically, and responsibly, while AI literacy involves understanding, evaluating, and appropriately using AI systems (Dringó-Horváth et al., 2025; Stolpe & Hallström, 2024; UNESCO, 2024b).

Within the selected contexts, participants reported using AI to accelerate information searches, explain *nahwu* and *sharf* rules, translate texts, and support learning material development. However, the convenience of AI-generated information was accompanied by the need for verification. An Arabic language lecturer in Indonesia stated, *"AI is very helpful in accelerating information searches, but the results still need to be checked to ensure that they are consistent with Arabic language rules"* (IN-3, interview, November 26, 2025). This practice involved comparing AI-generated outputs with dictionaries, reference books, and other scholarly sources. The finding indicates that AI use can encourage a shift from simply accessing information toward evaluating its accuracy and relevance (Yan et al., 2023; Yang et al., 2025).

The findings also indicate emerging practices of AI literacy among educators and learners. Participants described learning to formulate more effective prompts, select AI applications according to learning objectives, and recognize the limitations of AI-generated responses. However, the development of these competencies was not uniform across the selected contexts. In Indonesia, Southern Thailand, and some institutions in Malaysia, AI-related competencies developed mainly through individual experience, whereas in Brunei Darussalam and Singapore, their development was more strongly supported by institutional policies and learning systems. This pattern suggests that AI literacy is shaped not only by individual users' technological abilities but also by the institutional environment in which AI is used (Stolpe & Hallström, 2024; Tadimalla & Maher, 2024).

Overall, the findings suggest that the contribution of AI to digital literacy lies not simply in expanding access to digital information but in encouraging users to question, verify, evaluate, and responsibly apply AI-generated content. In Arabic language learning, this process is particularly important because inaccurate AI-generated information may affect linguistic accuracy and learning quality. At the same time, the development of these competencies depends on infrastructure, institutional policies, and educators' preparedness. Thus, AI can function as a catalyst for digital and AI literacy when its use is accompanied by critical evaluation, pedagogical guidance, and appropriate institutional support.

AI Contributions to Intercultural Communicative Competence

The role of AI in Arabic language learning extends beyond linguistic practice to the development of intercultural communicative competence (ICC), particularly when AI is used to explore culturally situated language use, communicative practices, and social perspectives. Within the selected contexts, participants reported using AI to access examples of everyday expressions, Arabic cultural practices, dialectal variations, communication etiquette, and situations that illustrate how language is used in particular social contexts. These findings

suggest that AI can broaden learners' exposure to the relationship between language and culture, which is an important dimension of ICC (Dai & Hua, 2025; Deardorff, 2020; Klimova & Chen, 2024).

The contribution of AI to ICC was particularly evident when it was used to construct or explore contextualized communication. An Arabic language teacher in Southern Thailand explained that ChatGPT could be used to generate conversation examples based on specific situations, helping students understand how Arabic is used in everyday communication (TH-2, interview, November 21, 2025). Such use moves learning beyond isolated vocabulary and grammatical forms by allowing learners to examine how language choices are related to communicative situations, interpersonal relationships, and cultural expectations. In this sense, AI can function as a resource for exploring the sociocultural dimensions of Arabic rather than merely as a tool for generating linguistic content.

However, the findings also indicate that access to cultural information through AI does not automatically develop ICC. AI-generated explanations may simplify cultural practices or provide generalized representations of particular communities. Therefore, learners and teachers need to interpret and verify AI-generated cultural information rather than treating it as an unquestionable representation of Arabic-speaking societies. This finding highlights the importance of critical engagement with AI-generated content, particularly when the content concerns cultural norms, communication styles, and social practices. The development of ICC consequently depends not only on exposure to cultural information but also on learners' ability to interpret cultural differences, reflect on communicative choices, and adapt their language use to particular contexts.

The findings further suggest that the contribution of AI to ICC is related to the quality of learning experiences in which it is integrated. In some of the selected contexts, AI was primarily used to enrich learning materials through dialogue examples, translation, and cultural explanations. In contexts with more integrated digital learning environments, AI was also associated with collaborative activities, adaptive learning, and broader access to digital resources. Rather than indicating fixed differences between countries, these patterns suggest that the depth of AI-supported intercultural learning depends on the extent to which teachers and institutions integrate AI into meaningful communicative and reflective activities.

From an Islamic Education perspective, this finding is relevant because intercultural learning involves not only acquiring information about other cultures but also developing responsible and respectful ways of engaging with difference. AI-supported Arabic learning can provide opportunities for learners to encounter diverse perspectives, but these opportunities require pedagogical guidance to prevent cultural information from being accepted uncritically or reduced to stereotypes. Thus, the pedagogical value of AI lies in supporting learners to examine cultural perspectives critically, communicate appropriately across contexts, and maintain responsible engagement with digitally mediated knowledge.

Overall, AI contributes to ICC when it is used to connect linguistic forms with cultural meanings, communicative situations, and social relationships. Its value therefore lies not simply in generating dialogues or translating texts, but in creating opportunities for learners to explore, interpret, and reflect on how Arabic is used in culturally situated communication. The findings support the view that AI can serve as a bridge between linguistic competence, digital and AI literacy, and intercultural communicative competence when its use is accompanied by critical interpretation, contextualized learning activities, and appropriate pedagogical guidance.

Taken together, the findings suggest that digital literacy, AI literacy, and intercultural communicative competence should not be viewed as separate outcomes of AI-assisted Arabic language learning. Rather, they are interconnected competencies that develop through the way learners access, evaluate, interpret, and use digitally mediated language and cultural information. Digital literacy enables learners to navigate and evaluate digital information, while AI literacy extends this capacity to understanding, questioning, and responsibly using AI-generated outputs. These competencies support ICC by enabling learners to critically interpret culturally situated information and adapt their communication to different social and

cultural contexts. From an Islamic Education perspective, this integrated process should be guided by ethical and pedagogical principles that emphasize responsible engagement with knowledge, critical evaluation of information, responsible technology use, and respect for cultural diversity. Therefore, the educational value of AI in Arabic language learning lies not merely in improving access to technology, but in creating a learning environment where technological competence, critical literacy, intercultural understanding, and educational values are developed together.

D. CONCLUSION

This study shows that AI integration in Arabic language learning varies according to educational ecosystem readiness, particularly digital infrastructure, institutional support, policies, and educator competencies. Three emerging modes of AI adoption were identified: AI as a tool supporting educators' activities, AI as part of institutional learning systems, and AI as part of adaptive, data-driven learning ecosystems. The main contribution of this study is to integrate AI adoption, digital and AI literacy, and intercultural communicative competence within an Islamic Education perspective. The findings indicate that AI can support critical information evaluation, responsible technology use, and culturally situated communication when accompanied by appropriate pedagogical guidance.

From an Islamic Education perspective, AI integration should promote responsible engagement with knowledge, critical evaluation of AI-generated information, and respect for cultural diversity. These findings are exploratory and cannot be generalized to national educational systems because the study involved 12 purposively selected participants with uneven distribution across five contexts. Future research should employ larger samples and quantitative, mixed-methods, or longitudinal designs to further examine these emerging patterns.

REFERENCES

Alayba, A. M. (2025). Arabic Natural Language Processing (NLP): A comprehensive review of challenges, techniques, and emerging trends. *Computers*, *14*(11), 497. https://doi.org/10.3390/COMPUTERS14110497

Chen, Y., & Wei, L. (2025). Effects of artificial intelligence learning environments on engineers' intercultural communication competence: mediating role of learning adaptability. *Interactive Learning Environments*, *33*(2), 1404–1421. https://doi.org/10.1080/10494820.2024.2371937

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: the state of the field. *International Journal of Educational Technology in Higher Education*, *20*(22). https://doi.org/10.1186/S41239-023-00392-8

Dai, D. W., & Hua, Z. (2025). When AI meets intercultural communication: new frontiers, new agendas. *Applied Linguistics Review*, *16*(2), 747–751. https://doi.org/10.1515/applirev-2024-0185

Deardorff, D. K. (2020). *Manual for developing intercultural competencies: story circles*. Routledge, Taylor & Francis Group. https://unesdoc.unesco.org/ark:/48223/pf0000370336

Dringó-Horváth, I., Rajki, Z., & T. Nagy, J. (2025). University teachers' digital competence and AI literacy: Moderating role of gender, age, experience, and discipline. *Education Sciences*, *15*(7), 868. https://doi.org/10.3390/EDUCSCI15070868

Hady, Y., Krisnawati, N. M., & Fatima, A. (2025). Artificial intelligence (AI), the erosion of tacit knowledge, and the challenges of cultivating wisdom: Epistemological and ethical implications for 21st century islamic education. *EDUKASI: Jurnal Penelitian Pendidikan Agama Dan Keagamaan*, *23*(2), 430–446. https://doi.org/10.32729/EDUKASI.V23I2.2407

Joseph, G. V., Athira, P., Anit Thomas, M., Jose, D., Roy, T. V., & Prasad, M. (2024). Impact of digital literacy, use of AI tools and peer collaboration on AI assisted learning- perceptions of the university students. *Digital Education Review*, (45), 43–49. https://doi.org/10.1344/DER.2024.45.43-49

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., … Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, *103*, 102274. https://doi.org/10.1016/J.LINDIF.2023.102274

Khoiruddin, M. A., & Dzulkifli, I. (2026). Integrating artificial intelligence in Islamic education: Ethical, pedagogical, and sustainability perspectives. *INTIHA: Islamic Education Journal*, *3*(2), 490–499. https://doi.org/10.58988/INTIHA.V3I2.458

Klimova, B., & Chen, J. H. (2024). The impact of AI on enhancing students' intercultural communication competence at the university level: A review study. *Language Teaching Research Quarterly*, *43*, 102–120. https://doi.org/10.32038/LTRQ.2024.43.06

Kristiawan, D., Bashar, K., & Pradana, D. A. (2024). Artificial intelligence in English language learning: A systematic review of ai tools, applications, and pedagogical outcomes. *The Art of Teaching English as a Foreign Language (TATEFL)*, *5*(2), 207–218. https://doi.org/10.36663/TATEFL.V5I2.912

Lee, S., Choe, H., Zou, D., & Jeon, J. (2026). Generative AI (GenAI) in the language classroom: A systematic review. *Interactive Learning Environments*, *34*(1), 335–359. https://doi.org/10.1080/10494820.2025.2498537

Liu, J. (2025). Exploring the impact of artificial intelligence-enhanced language learning on youths' intercultural communication competence. *Humanities and Social Sciences Communications*, *12*(1), 1757. https://doi.org/10.1057/s41599-025-06033-x

Miles, M. B., A. Huberman Michael, & Saldaña, J. (2019). Qualitative data analysis: A Methods sourcebook. In *SAGE Publicatons Inc.* (4th ed.).

Qian, Z., Altam, F., Alqurishi, M., & Souissi, R. (2024). *CamelEval: Advancing culturally aligned arabic language models and benchmarks*. https://arxiv.org/pdf/2409.12623

Samiya, R. (2025). Artificial Intelligence in Arabic language education: current applications, challenges, and future perspectives. *STUDIES IN EDUCATION SCIENCES*, *6*(4), e21277. https://doi.org/10.54019/sesv6n4-011

Stolpe, K., & Hallström, J. (2024). Artificial intelligence literacy for technology education. *Computers and Education Open*, *6*. https://doi.org/10.1016/j.caeo.2024.100159

Tadimalla, S. Y., & Maher, M. Lou. (2024). AI literacy for all: Adjustable interdisciplinary socio-technical curriculum. *IEEE Frontiers in Education Conference (FIE)*, 1–9. https://doi.org/10.1109/FIE61694.2024.10893159.

UNESCO. (2024a). *AI and technologies in education | UNESCO*. UNESCO. https://www.unesco.org/en/digital-education

UNESCO. (2024b). *Artificial intelligence in education - AI | UNESCO*. UNESCO. https://www.unesco.org/en/digital-education/artificial-intelligence

Xia, Y., Shin, S. Y., & Kim, J. C. (2024). Cross-cultural intelligent language learning system (CILS): Leveraging AI to facilitate language learning strategies in cross-cultural communication. *Applied Sciences*, *14*(13), 5651. https://doi.org/10.3390/APP14135651

Xiao, R., Tseng, Y.-J., Li, H., Nieu, H., Liao, G., Stamper, J., & Koedinger, K. R. (2024, December 15). ActiveAI: Enabling K-12 AI literacy education & analytics at scale. *Companion Proceedings 15 Th International Conference on Learning Analytics & Knowledge (LAK25)*. https://arxiv.org/pdf/2412.14200

Yan, L., Sha, L., Zhao, L., Li, Y., Martinez-Maldonado, R., Chen, G., Li, X., Jin, Y., & Gašević, D. (2023). Practical and ethical challenges of large language models in education: A Systematic scoping review. *British Journal of Educational Technology*, *55*(1), 90–112. https://doi.org/10.1111/bjet.13370

Yang, Y., Zhang, Y., Sun, D., He, W., & Wei, Y. (2025). Navigating the landscape of AI literacy education: insights from a decade of research (2014–2024). *Humanities and Social Sciences Communications*, *12*(1). https://doi.org/10.1057/s41599-025-04583-8

Zhang, X., Zhang, P., Shen, Y., Liu, M., Wang, Q., Gašević, D., & Fan, Y. (2024). A systematic literature review of empirical research on applying generative artificial intelligence in education. *Frontiers of Digital Education*, *1*(3), 223–245.

https://doi.org/10.1007/S44366-024-0028-5
Zhu, M., & Wang, C. (2025). A systematic review of research on AI in language education: Current status and future implications. *Language Learning and Technology*, *29*(1), 1–29. https://doi.org/10.64152/10125/73606