Vol.8 No.2 (2025)

Journal of Applied Learning & Teaching

ISSN : **2591-801X**

Content Available at : **http://journals.sfu.ca/jalt/index.php/jalt/index**

The present and future directions of metaverse, artificial intelligence, and second life environments in new language education within higher education: A systematic review

Noura Tegoan[A] [A] *School of Engineering & Technology, CQUniversity, Sydney, Australia*

Srimannarayana Grandhi[B] [B] *School of Engineering & Technology, CQUniversity, Melbourne, Australia*

Santoso Wibowo[C] [C] *School of Engineering & Technology, CQUniversity, Melbourne, Australia*

Rongbin Yang[D] [D] *Kaplan Business School, Adelaide, Australia*

Keywords

Artificial intelligence;
metaverse;
new language;
second Life;
teaching and learning;
technology adoption.

Correspondence

noura.tegoan@cqumail.com [A]

Article Info

Received 16 June 2025
Received in revised form 10 October 2025
Accepted 14 October 2025
Available online 14 October 2025

DOI: https://doi.org/10.37074/jalt.2025.8.2.19

Abstract

The Metaverse, Artificial Intelligence (AI), and Second Life (SL) environments signify the commencement of the next phase in educational revolution, which offers the opportunity to seamlessly integrate digital and physical realms in a multiuser immersive setting. Despite the substantial potential for harnessing the Metaverse, AI, and SL in the domains of learning and teaching, a notable deficiency exists in research investigating the benefits, challenges, and solutions of these technologies for language acquisition. This review aims to address this deficiency by examining the potential advantages, challenges, and future directions of these technologies within the context of language education. It analyses relevant studies from ScienceDirect, Emerald, SAGE, SpringerLink, IEEE Xplore, and JSTOR, which focus on studies from 2011 to 2025. Key findings reveal the benefits of Metaverse, AI, and SL, such as improved awareness, knowledge access, motivation, engagement, and support. These technologies contribute significantly to enhancing language learning and pedagogy. The challenges include ethical concerns, socio-emotional issues, and a lack of proficiency in educational virtual technologies. Nevertheless, the study provides constructive implications and solutions for integrating these technologies into language education, enhancing understanding of their benefits in new language education, while recommending how to incorporate them into higher education pedagogy.

Introduction

Second language (L2) education has increasingly attracted interests in higher education institutions because global organisations emphasise the importance of equipping students with multilingual competencies (Hwang & Chien, 2022). The demand for multilingual proficiency has consequently driven a rise in the number of educators who specialise in foreign language instruction (Williams et al., 2019). In response to this need, universities worldwide have expanded their offerings of distance-based language courses, which have resulted in significant improvements in both quality and accessibility. Simultaneously, pedagogical strategies are undergoing profound transformations through the adoption of advanced educational technologies (Hwang & Chien, 2022; Williams et al., 2019). These developments align with broader trends in higher education that prioritise the implementation of digital tools to enhance language teaching and learning.

Extended Reality (XR) technology has emerged as one of the most transformative in this domain. XR is a broad, overarching term that includes Mixed Reality (MR), Virtual Reality (VR), and Augmented Reality (AR) technologies. It refers to any segment of the reality-virtuality continuum that combines immersive digital elements with real-world components. This continuum spans from AR, where virtual elements are superimposed onto the physical environment, to augmented virtuality, which integrates real-world objects into a predominantly virtual space, facilitating novel interactive applications (Tegoan et al., 2021). XR technology enables the design of integrated environments that amalgamate real and virtual components, thereby promoting engaging and realistic experiences across all levels of language instruction. This advancement underscores the potential of XR as a substantial enhancement to the ongoing evolution of language teaching and learning.

Metaverse, AI, and SL environments are considered the next evolution of the educational revolution, as they create immersive, interactive learning spaces. The Metaverse, a term derived from the combination of two words, "meta", meaning after, and "universe" (Cheng et al., 2022), offers a new realm for education and interaction. AI plays an essential role in these platforms, as it ensures that Metaverse environments operate according to the rules defined by the designer (Hwang & Chien, 2022). Furthermore, SL is a 3D computer-simulated, immersive world where users, such as students, can communicate as avatars for educational, entertainment, or other purposes (Isgor Simsek & Baltaci, 2024). In addition, XR is considered the backbone and essential support system of the Metaverse, merging real and virtual environments to create lifelike, immersive experiences. This combination of immersive technologies makes education more interactive, realistic, and engaging within the Metaverse and SL environments (Tegoan et al., 2024). The rapid growth of Metaverse platforms, which have attracted millions of students and teachers, demonstrates the expanding potential of this technology. A recent study by Saritas and Topraklikoglu (2022) revealed that 42 million people globally are active Metaverse users, which underscores its growing presence. Immersive technologies, including XR, are transforming education by creating new communication paradigms (Tegoan et al., 2021). These digital reality environments are gaining interest from educators, who see their potential to overcome the fundamental limitations of traditional education (Saritas & Topraklikoglu, 2022).

Despite growing interest in these immersive technologies, a noticeable gap remains in research regarding their application in language education (Zhai et al., 2024). Specifically, there is a lack of extensive studies examining the effective use of the Metaverse, AI, and SL in language learning and teaching. Additionally, only a few studies have addressed the benefits, challenges, and solutions associated with employing these technologies into new language learning and teaching. To address this gap, the present review aims to outline the potential benefits and challenges, provide solutions to these challenges, and offer clear future directions for the adoption of Metaverse, AI, and SL environments in language education. By undertaking this initiative, this study aims to enhance the comprehension of how immersive technologies can be effectively and efficiently utilised within the context of new language instruction and acquisition.

In alignment with the aims, three research questions are articulated to direct this systematic review and analysis of pertinent research papers that contribute to an enhanced understanding of the potential benefits and challenges associated with the implementation of immersive technologies in the context of new language learning and teaching.

RQ1: What are the benefits of using the Metaverse, AI and SL for learning and teaching a new language in higher education?

RQ2: What are the privacy, ethical and social concerns associated with the use of the Metaverse, AI, and SL environments for learning and teaching a new language in higher education?

RQ3: What are the future directions of applying the Metaverse, AI and SL for learning and teaching second languages within higher education?

Systematic review methodology

This study adopts the guideline of Wolfswinkel et al. (2013) for conducting the systematic review of the literature which include (a) defining the scope of the review, (b) searching the literature, (c) selecting the sample, (d) analysing the sample, and (e) presenting the findings. This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines (Page et al., 2021), which are appropriate for the qualitative nature of this study and ensure transparency, replicability, and methodological rigour. The review focused on peer-reviewed studies that examined the application of the Metaverse, AI, and SL in language education within the higher education context.

In the initial stage, six major academic databases, such as Emerald, ScienceDirect, SAGE, SpringerLink, JSTOR, and IEEE Xplore were selected. These databases were chosen for their scholarly credibility and broad coverage of peer-reviewed research in education, educational technology, and applied linguistics. The search strategy combined keywords and Boolean operators, supplemented with Medical Subject Headings (MeSH) terms where applicable. Search strings included combinations such as 'Metaverse' AND 'Second language' OR 'AI' AND 'teaching language' OR 'learning a second language' AND 'immersive educational environment' OR 'virtuality' AND 'new language learning' OR 'virtual online learning environment' AND 'challenges in teaching a new language'. The time range of the search covered articles published between 2011 and 2025. The inclusion and exclusion criteria are summarised and presented in Table 1. The second stage involves running the search query within the selected databases for retrieving the search results using the above pre-defined search strings. The initial search results were screened at the title and abstract level to remove clearly irrelevant records. To reduce selection bias, the screening and study selection process was carried out by three independent reviewers, with disagreements resolved through discussion until consensus was reached. This initial search provides a general understanding on the application of the Metaverse, AI, and SL in language education within the higher education. Studies not published in peer-reviewed journals, articles without a clear focus on language education, and those studies which fall outside 'learning technologies', 'Metaverse', AI technology', 'SL platform', 'new language', and 'teaching and learning languages' were excluded. The next stage involves an in-depth analysis on the potentially useful publications by reading the full article. In this last step, the most important aspect was to evaluate the full article for ensuring its relevancy to the research questions. Following PRISMA guidelines, studies were identified, screened, and assessed for eligibility. Figure 1 shows the PRISMA diagram for illustrating the procedures followed in the systematic review process.

Table 1: Inclusion and exclusion criteria.

Inclusion	Exclusion
Research studies on Metaverse, SL and AI environments	Research studies that are not peer-reviewed.
Research studies include learning and teaching a new language.	Research studies not published in the English language.
English language	Research studies are abstracts, reports, and posters.
Peer-reviewed studies from 2011- 2025	Papers falling outside 'learning technologies', 'Metaverse', AI technology', 'SL platform', 'new language', and 'teaching and learning language'.
Research employing robust methodologies is essential.	Published before 2011.

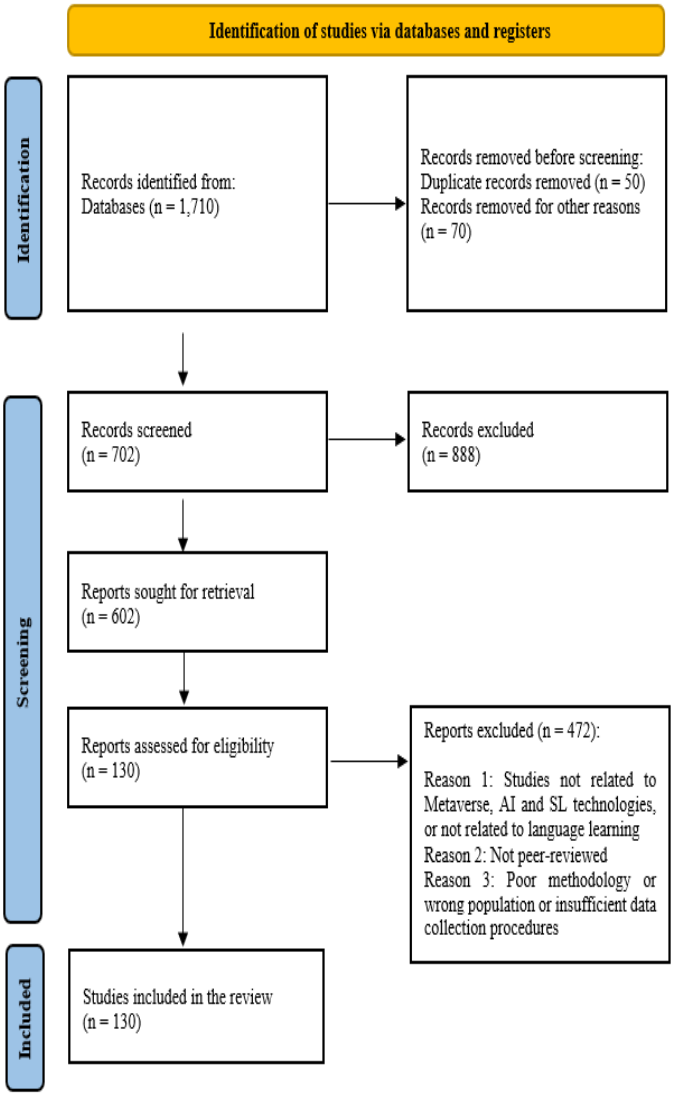

Figure 1: PRISMA flowchart.

Data analysis and synthesis

A data extraction sheet was designed to record study characteristics (first author, year), publication details, research aims, methods, participants, technologies studied, and key findings. The extracted data were then thematically analysed in relation to the three research questions, which ensured alignment between the review outcomes and the stated objectives. This review comprised the collection, identification, analysis, and reporting of data. A six-step process was employed to identify the recurring themes. Firstly, a thematic analysis was undertaken to achieve a comprehensive understanding of the data. Subsequently, initial codes were developed. In the third and fourth stages, sub-themes were discerned and examined. In the fifth stage, pertinent concepts were compiled. Finally, in the concluding stage, the data were reviewed to ascertain their relevance to the objectives of this study (Daud et al., 2021). This review has been created to summarise the pedagogical adoption of the Metaverse, AI, and SL environments in language learning and teaching.

The initial methodological quality of the included studies was assessed using the qualitative research method. The ROBIS (Risk of Bias in Systematic Reviews) tool (Whiting et

al., 2016) was used to assess risk of bias in the systematic review. Both Boolean operators and, where available, MeSH terms were used to enhance the comprehensiveness of the search. The search terms included combinations such as: 'Metaverse' AND 'Second language' OR 'AI' AND 'teaching language' OR 'learning a second language' AND 'immersive educational environment' OR 'virtuality' AND 'new language learning' OR 'virtual online learning environment' AND 'challenges in teaching a new language'.

To reduce selection bias, the screening and study selection process was carried out by three independent reviewers who conducted the appraisal, and discrepancies were resolved through discussion until consensus was reached to ensure reliability. A copy of the data extraction template is provided in Appendix 1. Studies were not excluded based on appraisal scores; instead, the results of the assessment informed the interpretation of the findings. As the majority of included studies employed qualitative or mixed-method designs, a quantitative meta-analysis was not performed. This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines, which are appropriate for the qualitative nature of this study and ensures transparency, replicability, and methodological rigour.

Results

This systematic review offers a valuable opportunity to shed light on the benefits of applying Metaverse, AI, and SL technologies for learning and teaching new languages in the education sector. The research studies that emerged from the databases have undergone a two-step screening process. Initially, a review of the titles and abstracts of the retrieved papers is conducted to determine their compliance with the inclusion criteria (Regmi & Jones, 2020) and to remove records that are clearly irrelevant to the scope of this review. Subsequently, the full text of the studies meeting the inclusion criteria was reevaluated and obtained through the database search to ensure that their content, methodology, and results aligned with the research objectives. A total of 1,710 records were identified through electronic databases, including 41 studies from Emerald, 33 studies from SAGE, 399 studies from SpringerLink, 31 studies from JSTOR, 184 studies from ScienceDirect, and 1,022 studies from IEEE Xplore. These records were subsequently narrowed down to 822 studies following thorough screening, examination, and the removal of duplicates and irrelevant studies. During the screening stage, 888 records were excluded as duplicates or because they were unrelated to the scope of this review. Following a suitability assessment, 602 full-text articles were evaluated for eligibility, and 472 were excluded for the following reasons: not peer-reviewed, poor methodological quality, wrong population, not directly related to Metaverse, AI, SL, or language learning, inappropriate use of meta-analysis, or insufficient data collection procedures. Ultimately, 130 studies met the inclusion criteria and were incorporated into the final synthesis. Appendix 1 presents a summary of the challenges, influencing factors, research methodologies, delivery methodologies, drivers and key findings.

Figure 2 illustrates the total number of published papers across various databases. The findings show that the majority of papers were published in the IEEE Xplore database, while JSTOR had the fewest. SpringerLink ranked second, followed by ScienceDirect, Emerald, and SAGE databases.

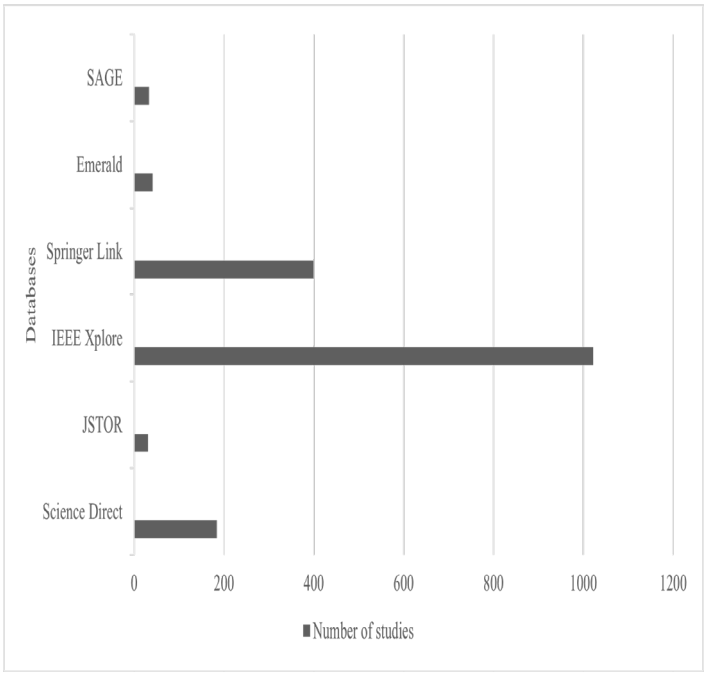

Figure 2: Distribution of the selected academic databases and the total number of publications.

Furthermore, Figure 3 illustrates the number of studies retrieved from six academic databases as part of a systematic literature review. IEEE Xplore produced the highest number of studies, followed by SpringerLink and ScienceDirect, likely due to their stronger emphasis on research related to the Metaverse, Second Life, and AI applications in language education. In contrast, Emerald, SAGE, and JSTOR yielded fewer studies, possibly due to their more limited alignment with the review's thematic scope and differing methodological orientations.

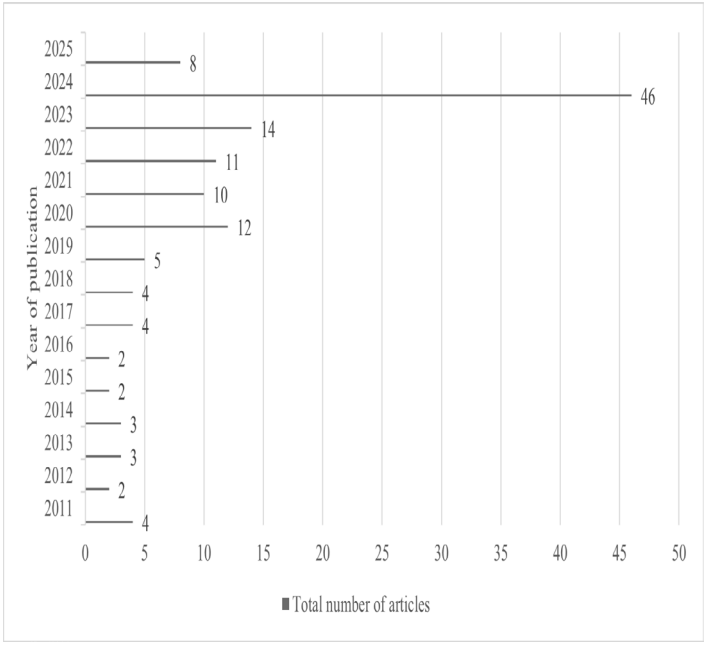

Figure 3: The distribution of the total number of studies published annually from 2011 to 2025.

This review distinguished four central notions from the studies on the benefits and implementation of Metaverse, AI and SL technologies in higher education. These are (a) addressing privacy concerns, security problems and ethical considerations, (b) accelerating language learning and teaching improvement and progress, (c) supporting students' behaviour, fluency, awareness and engagement and (d) invoking students' motivation and attention. Furthermore, some challenges relating to using Metaverse, SL and AI environments were identified. The difficulties arise from issues related to the Metaverse, SL, and AI devices and applications, as well as the limitations of the foreign language education system.

Addressing some privacy concerns, security problems and ethical considerations

With the expected rise in the number of foreign language learners globally, it is necessary to utilise immersive technologies to enhance teachers' tutoring duties and support learners who face limitations, such as limited storage capacity. Students often need to save their sensitive personal work (Kamenskih, 2022), such as academic records, in larger storage capacities that are easily accessible for use and sharing. This sensitive data can be stored in the cloud and other secure locations that protect it from destruction and unauthorised access by third parties. Hwang and Chien (2022) noted that utilising the Metaverse for educational purposes addresses several potential ethical issues commonly encountered in traditional study environments, including cheating, bullying, privacy concerns, offence, security breaches, and educational inequality. Moreover, by utilising Metaverse-based educational settings, students can have continuous learning opportunities without being limited by time or physical space. In an AI environment, the Metaverse technology provides students with direct feedback, comments on their work, immediate assistance and prompts to enhance training and learning efficiency. For example, AI can be a tutor for EFL students who can receive feedback, answers and suggestions regarding their English writing skills. Kovacs (2016) demonstrated that some researchers have pointed out that MUD object-oriented (MOO) environments might be effective for quiet and shy students who cannot participate in real-life contexts. They become more successful in using the MOO environment and are more interested in learning new languages. Meanwhile, SL has addressed the most significant obstacles to engaging in the SL and Avatars environments that prevent students from developing their foreign language efficiently, including behaviours such as fear of negative criticism and shyness (Garcia & Silva, 2018). The appearance of the avatar character could be created easily by the students. Therefore, they can initiate learning experiences independently (Salmon, 2009), which can reduce anxiety and stress, and raise learning engagement and motivation (Ushioda, 2011). Kovacs (2016) demonstrated that some researchers have pointed out that the MOO environment might be effective for quiet and shy students who cannot participate in real-life contexts. They become more successful in using the MOO environment and are more interested in learning new languages. Furthermore, academics can provide learners with immersive experiences by finding primarily target-language environments where users can practice their new language skills and learn about the target culture and background.

Accelerating language learning, teaching improvement and progress

One hundred and thirty studies reported that Metaverse, SL, and AI-based education had successfully facilitated learning and teaching in universities and schools (Canto et al., 2013; Dawilai et al., 2025; Liou, 2012; Suo, 2024). The adoption of XR and AI offers transformative potential for second language learning by providing immersive, interactive, and personalised experiences (Zhou & Divekar, 2025). For example, Hwang and Chien (2022) explained that by using the Metaverse environments, English foreign language (EFL) students could receive feedback and suggestions regarding their English language writing and utilise the AI tutor as an immersive tutor. Dong et al. (2022) pointed out that AI technology has contributed to the creation of new language learning and teaching across a wide range of fields, such as Robot Assistants, Chatbots, holograms, Seeing AI, Vidreader, Classcraft, 3D and other AI-based virtual programs were developed to assist both teaching staff and students in using and improving the educational system. Hwang et al. (2020) provided a definition and examined the roles of AI in education from the perspective of educational needs. The authors explained that AI-based education is becoming a primary research focus in foreign language learning and computer-assisted teaching, which leads to better writing outcomes than those achieved through traditional instruction. Tuncer and Simsek (2015) described 3D VLEs as computer-generated displays that enable users to experience a sense of presence in an environment other than their current one and interact with that technology. 3D multi-user virtual environment (3D MUVE) can create a sense of presence among peer students through their avatars in a 3D environment, facilitating real-time communication that can ease connection building, student motivation, and engagement. Students can be presented in this environment by making a new character as an avatar (Ushioda, 2011). The appearance of the avatar character could be created easily by the students. Therefore, they can initiate learning experiences independently (Salmon, 2009), which can reduce anxiety and stress while increasing learning engagement and motivation (Ushioda, 2011). Moreover, Haristiani (2019) believed that integrating AI-powered chatbot technology could facilitate language learning, enhance students' understanding of lectures, and increase confidence in their language learning experience through less direct interaction with human teachers.

Supporting students' behaviour, fluency, awareness and engagement

Prior studies (Dong et al., 2022; Goda et al., 2014) have investigated how students who are learning English as a foreign language are interested in using virtual English chatbot tutors, which enable learners to form inquiring mindsets and increase their engagement and awareness of critical thinking. Dooly and Sadler (2013) introduced the SL environment and immersive online collaborations that enhanced educator

development through opportunities unavailable in some traditional educator education classrooms, enabling learners-educators to establish better connections between theory and practice. Learners-educators became more professional, engaging in the creation of better lessons and transitioning from knowledge transmission to knowledge transformation. Tuncer and Simsek (2015) demonstrated that the SL environment enables its avatars to utilise body language, which facilitates communication and interaction among avatars, and from which language education and distance learning applications may also benefit. With this real-time synchronous interaction, students can create groups, learn in collaboration, and engage in entertainment. Therefore, the students can attend activities more positively, supporting their foreign language learning. Emerging models of Metaverse-enabled online education possess the potential to address the issues and limitations inherent in traditional 2D platforms. Meta-education can consistently deliver essential hybrid formal and informal active learning and teaching experiences, expand online 3D virtual campuses, and develop contemporary curricula (Mystakidis, 2022). In essence, the Metaverse platform is anticipated to induce a substantial transformation in the domains of learning and teaching, especially within higher education studies. For example, Molka-Danielsen et al. (2007) clarified that virtual and immersive worlds, such as Linden Labs SL, could be established as an opportunistic platform for future online learning and teaching purposes. Over 160 higher education centres, as associates of the New Media Consortium (NMC) forum, have already developed programs and conducted virtual meetings in the virtual world of SL, created by Linden Labs. Many higher educational centres have been designed to motivate efficient use of time and reach learners with mobile lifestyles. Still, more current ventures into SL education aim to achieve collaboration between educators while improving the learning process. From a teaching perspective, traditional educational resources such as personnel knowledge, acquaintance, competency, and foundations have been limited. The author described how being capable of accessing distributed teaching resources through immersive worlds, such as SL, can offer advantages compared to other online resources; SL also provides a richly immersive educational environment. That is because SL supports rich virtual educational environments and social interactions and allows open access.

Invoking students' motivation, attention and socio-emotional development

Virtual multimodal teaching and immersive learning can utilise metaverses to enhance the motivation and attention of less proficient students, while also supporting collaboration and language progress (Lee & Kim, 2016). For example, 3D MUVE can create a sense of presence among peers through the use of avatars within a 3D setting via real-time communication. This interaction can enhance the development of connections, increase student motivation, and foster engagement. The student can be presented in this environment by making a new character as an avatar (Ushioda, 2011). Alfadil (2020) demonstrated the effects of using the Metaverse platform, which can enhance the quality of immersive learning experiences and develop learners' fluency in language learning. For example, the author assured that the 'House of Languages' game, which focuses on language vocabulary acquisition, revealed that students who used it achieved better results in language skills and vocabulary acquisition than ever before. According to Kovacs's (2016) study, it is noted that MOOs (3D MUVEs) have effectively captured the attention of educators. Many MOO platforms were created for learning second languages, such as MOO Rouge, MOO Francais, Schmooze University and Mundo Hispano. As MOOs are majorly text-based, they rely on the educators' sense of community and imagination to create and expand their virtual environment. MOOs are established to cultivate users' creativity. The author also investigated the interactional tools utilised by a language instructor with learners in a second language setting in MUVE of SL, which were employed to generate meaning and communicate effectively with students, including visual addressivity, reception checks, and channel checks. Furthermore, the author observed that although some teachers and researchers are interested in exploring the potential of conducting teaching and learning experiences in MUVEs, there is still a limited amount of research in this area. Within MUVEs, social constructivism provides a useful framework for understanding the role of peer interaction, mutual problem-solving, and community-based engagement in language learning. To complement this perspective, the Technological Pedagogical Content Knowledge (TPACK) framework is employed as a direct theoretical reference (Mishra & Koehler, 2006). TPACK emphasises on the dynamic interplay between technology, pedagogy, and content knowledge and provides a system, a systematic framework to study how immersive technologies, like Metaverse platforms, AI, and simulation-based learning, can be successfully used in language learning. The integration of social constructivism and TPACK provide a coherent theoretical framework for the identified benefits, challenges, and pedagogical implications in this systematic review. SL technology is regarded as one of the most prominent virtual environments among educators. It has drawn the interest of numerous language learners and instructors due to three fundamental aspects: (a) the experience of embodiment or presence that users experience through avatars, (b) the synchronous voice functionality, and (c) its adaptable design capabilities.

Challenges in utilising Metaverse, AI and SL environments

Despite the benefits of the Metaverse, AI, and SL environments for language learning and teaching, some research studies have explained the challenges of applying these virtual environments. For example, Haristiani (2019) argued that while considerable research and development have occurred in the field of chatbots for English language learning, their availability remains limited in specific languages. There are still some privacy concerns and issues of honesty that need to be addressed. Molka-Danielsen et al. (2007) demonstrated that educators should consider technical access problems and new teaching procedures and establish the learning space accordingly. The authors illustrated the issues in distance education that applied to the context of teaching second languages. They suggested that closed systems, such as remotely accessed proprietary

learning management systems, can create a knowledge gap when used to teach foreign languages. Although this system may offer access to large databases on specific subject matter, the closed virtual environments could create an issue, as noted by Dalsgaard (2006). The point of mixing personal learning tools and networked equipment in a closed, controlled environment is a dilemma for the social constructivist theory of learning a new language. Furthermore, Felix (2003) cautioned that, despite meticulous planning, certain educators perceive MOOs as anarchic and find the rapid scrolling of text to be bewildering. The author articulated that, while educators may organise language classes with a high degree of effectiveness, there exists a measure of uncertainty regarding the findings due to the playful characteristics of the MOO and the anonymity that the environment affords to learners. The discourse of academics and the purposes of their roles have been evaluated during the pre-task, task, and post-task stages of task-based classes that implemented the SL environment. Felix (2003) deduced that the tutor must be prepared to provide a positive learning environment that mitigates the negative impact of technical issues during class time and resolve them. Consequently, after the adoption of the MUVE environment, the teaching and learning process becomes more flexible and exciting (Wang, 2015).

Alfadil (2020) assured that research on language vocabulary education using the Metaverse and immersive platforms remains limited. Dwivedi et al. (2022) and Hwang and Chien (2022) asserted that there are still limitations and challenges associated with using Metaverse software for language learning and teaching, including spatial constraints, time constraints, safety concerns during the learning process, and cost issues related to development and adoption. Haristiani (2019) argued that considerable research and chatbot development for English language learning have been created, but this is still limited and not available in other languages. Hwang et al. (2020) found that the challenges extend beyond computer programming skills to include the procedures for simulating the intelligence of human experts. Dahan et al. (2022) reported that the Metaverse platform remains unclear in teaching and learning new languages, and its components are not precisely defined. Bower (2017) explained that while using the SL platform, it can be difficult to identify participants in the class from their Avatar characters. Jeon et al. (2022) encountered some technical limitations of a videoconferencing tool, like Zoom, regarding its temporary nature and the lack of embodied learning in online teaching. The most significant obstacles to engaging in the SL and Avatar environments that prevent students from developing their foreign language efficiently are related to fear of negative criticism and shyness (Garcia & Silva, 2018). This socio-emotional barrier is further compounded by the technical and pedagogical challenge of converting a 3D environment into an effective learning platform, which can limit the support structures needed to reduce anxiety and encourage active participation (Ibanez et al., 2011).

The application of Metaverse, AI and SL in new language education

The application of Metaverse, AI, and SL immersive technologies has advanced remarkably, with their use becoming increasingly evident across various sectors. A growing body of research has explored the transformative influence of AI on language education, emphasising its potential to revolutionise teaching methodologies and learning engagement (Chau, 2025). These investigations encompass AI-driven platforms such as Duolingo, Google Translate, and Prep.com. The findings indicate that AI offers both opportunities and challenges within educational contexts. AI technology facilitates personalised and adaptive learning experiences, providing immediate feedback that enhances student engagement. El-Zeiny et al. (2023) evaluated the effectiveness of AI-driven storytelling in improving pronunciation skills among non-native Arabic speakers. This research demonstrated the benefits of digital storytelling in fostering both reading-aloud proficiency and learner motivation. Moreover, Wen et al. (2025) highlight how AI can personalise learning experiences, provide instant feedback, and facilitate immersive language practice that enhances learner engagement and proficiency. Further advancing this area, Shao et al. (2022) introduced the AI-based Arabic Language and Speech Tutor (AI-ALST), specifically developed for instruction in the Moroccan Arabic dialect. The AI-ALST supports self-directed pronunciation practice by offering corrective feedback and utilising performance metrics, such as F1-score, accuracy, precision, and recall, to assess pronunciation accuracy. In addition, the role of advanced AI models in education has been explored through the integration of Bidirectional Encoder Representations from Transformers (BERT), a language comprehension model, into language learning applications. BERT provides personalised and immersive experiences across vocabulary, grammar, reading, and writing (Pradhan et al., 2024). Prasad et al. (2024) also examined the effectiveness of Sequence-to-Sequence (Seq2Seq) models with attention mechanisms in evaluating and forecasting the progression of learners of English as a second language, with a particular focus on the unexplored relationship between second language (L2) vocabulary size and speaking fluency, specifically pronunciation.

Deep learning continues to transform language education and assessment, providing educators with robust tools for teaching a second language. According to Gay and Gervais (2025), while innovative technologies still developing and achieving widespread adoption, they open new opportunities for educators to enrich the learning experiences of students and improve the evaluation of academic assessments. Basaran (2024) investigated a locally developed AI system using Retrieval-Augmented Generation (RAG) compared with the ChatGPT platform to recognise gender-specific profession names that reflect ongoing advancements in localised applications. Prabakaran et al. (2025) explained the effectiveness of metaverse-based platforms in improving English language proficiency and digital literacy among higher education students. The study found that immersive simulations and interactive scenarios within the metaverse foster collaborative learning, critical thinking, and practical language use, which leads to enhanced learning outcomes.

Ng et al. (2024) noted that immersive environments such as Questverse, the metaverse-based platform being connected with Spatial.io, have also been developed to facilitate interactive language learning experiences. This virtual space enhances teacher-student engagement and supports stage speech training through AI-guided chatbots. Their results indicate that students feel notably more comfortable engaging in oral English exercises guided by an interactive chatbot. AI technology continues to give rise to a variety of new language educational tools across various fields, including Robot Assistants, Chatbots, Holograms, Seeing AI, Vidreader, Classcraft, and other 3D virtual applications that are designed to assist both educators and students in utilising and enhancing the educational system (Dong et al., 2022). The implementation of Metaverse, AI, and SL platform-based smart classrooms, along with virtual teaching assistants, holds substantial potential for advancing language teaching methodologies. However, despite their promise, these immersive tools remain supplementary and have yet to be fully integrated into mainstream curricula. While such technologies offer opportunities to enhance language education, the literature suggests that they do not entirely resolve existing challenges. Studies have identified persistent issues, such as limited language availability in AI chatbots (Haristiani, 2019), technical difficulties, and the need for revised pedagogical approaches (Molka-Danielsen et al., 2007; Zhai & Wibowo, 2023).

Discussion

Technology adoption in language education has been a significant area of interest worldwide in recent years, with numerous studies shedding light on its benefits and challenges. Metaverse, AI, and SL technologies offer a promising enhancement in higher language education. This systematic review is considered one of the most critical current studies investigating and synthesising the advantages and challenges of applying AI, SL, and Metaverse environments in learning and teaching systems. These immersive technologies have the potential to address challenges related to privacy, security, ethical considerations, and socio-emotional well-being. Their adoption has also shown significant benefits in improving language learning and teaching strategies, which result in enhanced students' fluency, awareness, engagement, motivation, and attention. Nevertheless, challenges concerning privacy, social implications, and ethical responsibility remain critical and must be carefully addressed. Moreover, issues such as limited availability of chatbots, high costs, and technical problems necessitate systematic identification and resolution to ensure sustainable adoption in educational practice. Despite these challenges, the adoption of virtual environments will reshape the language education approach, making teaching and learning a more dynamic, stimulating, flexible, attractive, and exciting experience. Overall, the results of this review indicate that the adoption of Metaverse, AI, and SL technologies holds strong potential to positively transform the landscape of language education, especially within the higher education sector.

RQ1: What are the benefits of using Metaverse, SL and AI environments for learning and teaching a new language in higher education?

This study showed that these technologies were integrated to enhance the overall educational experience for both students and teachers. While a substantial number of studies explored the advantages of using the Metaverse and SL in the development of learning and teaching new languages, some research papers also examined concerns and challenges associated with their implementation. These concerns included technical issues, ethical considerations, socio-emotional challenges and potential barriers to the adoption of these technologies in language education. The studies explored the effectiveness of immersive technologies, demonstrating their ability to enhance language engagement, assist learner behaviour, and address various concerns. Many studies focused on AI and chatbot adoption highlighted their potential to augment the teaching and learning experience, offering personalised assistance, immediate feedback, and innovative approaches to language instruction, as well as their advantages in language education (Chau et al., 2025; Dong et al., 2022; Goda et al., 2014; Kim, 2019; Kim et al., 2021; Mayormente et al., 2024; Rani, 2022) It can be observed that there is significant potential in this context. For instance, two case studies (Dong et al., 2022; Zhai & Wibowo, 2023) have explored the high interest of English language students in using virtual English chatbot tutors. These tutors foster inquiring mindsets, enhance active engagement, and raise awareness of critical thinking skills. The authors maintained that AI tutors would revolutionise teaching methods for English courses and create an effective environment to boost students' engagement and fluency in a new language acquisition. Dong et al. (2022) concluded that the development of virtual teaching assistant robots and smart classrooms based on AI has revolutionised English teaching and learning procedures and highlighted students' motivation and awareness.

AI-powered teaching support and chatbot technologies have made vital strides in learning and teaching the English language, but they remain relatively limited in other languages. To achieve the highest standards in the education process, it is vital to integrate these new immersive technologies alongside traditional teaching methods and in multiple languages. This combination can lead to great success in creating a dynamic and excellent learning environment. Meanwhile, Kim (2019), Zhai & Wibowo (2023), and Liu et al. (2025) support a similar perspective that emphasises the importance of AI implementation. Kim (2019) and Haristiani (2019) have introduced the role of AI-powered chatbots in language learning. Most English language students have reported that chatbot AI is useful, enjoyable and practical. This new technology creates an effective educational environment, significantly improving their English grammar skills. Using chatbots also creates a sense of engagement and motivation that positively affects the learning process. The authors assured that AI-powered chatbot technology could enhance language understanding and confidence in the language learning experience by reducing the need for direct interaction with human teachers. As Dong et al. (2022) discussed, AI technology

has made considerable advancements in this field. The authors highlight the significant contributions of AI-based programs, such as Robot Assistants, Chatbots, holograms, Seeing AI, Vidreader, Classcraft, 3D, and virtual tools, developed to support teachers and students in language education. It is suggested that researchers explore the adoption of immersive technologies in language education more thoroughly in their future studies.

In addition, the study results focused on AI technology that enhances language teachers' ability to deliver content and make language learning more engaging and flexible, similar to the project by Hwang et al. (2020). The authors explained the roles of AI-based education from the perspective of educational needs. The authors assured that AI tools are becoming a primary research focus in foreign language learning, which results in improved English writing outcomes. It can be observed that AI-based education can truly assist students in their journey and enhance teachers' content preparation. For example, Al-Barakat et al. (2025) investigated how teachers' TPACK profiles impact their intention to adopt Educational AI Tools (EAITs) in language teaching. The study explained that constructivist pedagogy supports language education through collaborative learning situations and the encouragement of authentic tasks, which strengthen understanding, memorisation of vocabulary, and grammar skills. The findings suggest that enhancing teachers' TPACK can facilitate the effective adoption of innovative technologies in language education. On the other hand, the authors discovered that the challenges are not only related to computer programming skills but also to the procedures of simulating the intelligence of human experts. Based on the empirical evidence on AI technology adoption in education, my perspective is that AI technology can aid language academics in supporting students as they learn new content, thereby facilitating a smooth increase in students' understanding. Teaching and learning by implementing AI technology can overcome the obstacles associated with traditional teaching and learning methods and become more flexible in terms of time and place. Consequently, many changes would lead to greater confidence in learning and teaching languages using AI technology than relying solely on direct human instruction.

Additionally, the SL environment facilitates its avatars in the utilisation of body language, thereby enhancing communication and interaction among avatars. This unique capability may also prove advantageous for language education and distance learning applications, as indicated by Tuncer and Simsek (2015). The authors emphasised that through this real-time synchronous interaction, students can form groups, engage in collaborative learning, and participate in entertainment activities. Baek and Lee (2023) provided a comprehensive overview of the Metaverse, while other studies expanded their investigations to include the SL environment as well. Generally, Baek and Lee (2021) affirmed that both Metaverse environments and the adoption of immersive social networking exert a significant influence on learners' speaking proficiency and comprehension skills. However, the authors noted that EFL teachers found it challenging to adapt to the Metaverse environment and its immersive implementations, due to the increased workload for both students and teachers. It is widely believed that utilising virtual environments in language education holds considerable promise, and there exists a sincere effort to balance practical pedagogical practices with immersive technologies to mitigate potential future challenges. The motivating advantages of the 3D MUVE platform in language education, as illustrated by Grant et al. (2014), include the motivational implications of a 3D MUVE setting, such as SL, for students learning the Chinese language. The 3D MUVE environments possess the capacity to stimulate students' motivation, improve their verbal and oral skills during participatory learning activities, and enhance their language acquisition performance, including word pronunciation. This immersive learning atmosphere bolsters language skills and reduces anxiety within the 3D MUVE context. Lee and Hwang (2022) explored the integration of virtual reality creation with a Metaverse platform to facilitate sustainable and adaptive educational practices. The authors concluded that these transformative experiences offered by VR-Making (herein referred to as VRM) for instructional content bolster pre-service teachers' technological readiness, perceived pedagogical advantages, and digital citizenship. Furthermore, they can facilitate student experiences, thereby ensuring equitable learning opportunities and motivation. It is believed to foster technological readiness among teachers, preparing them for immersive classrooms.

Furthermore, constructive views of SL platforms focus on learning and teaching; one agrees with the potential of virtual reality technologies in language education, as explained by Jeon et al. (2022) and Dooly and Sadler (2013). It is believed that these immersive technologies can create an engaging, flexible, and exciting atmosphere, revolutionising language education. The Korean education system has benefited from the application of virtual technologies, as clearly explained in Jeon et al.'s (2022) work. The author explored the pedagogical affordances of virtual environments. They showed how Korean EFL pre-service teachers gained advantages by noticing the synthesis of qualitative evidence in virtual environment development projects. These virtual educational environments and videoconferencing tools facilitate substantial engagement in technology development, which has the potential to augment participants' autonomy, active learning, awareness, self-efficacy, and motivation to utilise Information and Communication Technology (ICT) affordances in language instruction. This represents a significant advancement in language education. Nevertheless, educators still need to navigate the complexities associated with the effective integration of these technologies into their teaching systems.

Regarding Dooly and Sadler's (2013) perspective, they explained the advantages of SL environments for educator development, focusing on how they bridge the gap between practice and theory. Learner-educators became more professional by creating better immersive lessons and moving to knowledge transformation. I believe this bridge can empower teachers to develop more immersive classes, shifting from knowledge transmission to transformation. It is found that the insight highlighted in Bower's study (2017) aligns with my perspective on the use of 3D and SL in Australia. Bower focused on the benefits of virtual environments to facilitate 3D simulations, role-plays, immersive learning and SL in teaching second languages in Australian and New

Zealand educational centres. It is believed that SL adoption can lead to a positive shift in language education, as this technology can boost students' confidence and proficiency. However, the author explained that it could be challenging to identify participants in the class from their Avatar characters after using the SL platform. It can be observed that it is vital to solve some learning challenges before they adversely affect the learner and educational progress. Similarly, some obstacles pointed out by Jeon et al. (2022) are worth considering. The author examined various technical limitations associated with videoconferencing tools, like Zoom, specifically noting its transient characteristics and the absence of embodied learning within the realm of online education. Additionally, 3D multimodal resources in the SL environment offer foreign language students studying English visual and linguistic support, thereby enhancing language acquisition and pedagogical practices through virtual learning experiences.

Chen (2016) asserted that the SL environment represents a viable learning technique, owing to its prominent features, immersive qualities, and opportunities for co-presence. Nevertheless, the author noted in his project that unforeseen computer crashes and technical difficulties may arise when re-entering the SL in-world. The extension of this discussion to virtual platforms and their advantages is highlighted by Pasfield-Neofitou et al. (2015) and Peterson (2012). They described the SL and 3D multi-user virtual environments as enjoyable and beneficial experiences. These technologies provide stimulating environments for language learners to engage in various valuable social interaction activities. As a result of applying the SL environment in Japanese language learning, limited typing skills and difficulties in navigating the messaging system have been observed, leading to communication breakdowns (Peterson, 2012). This aligns with my thoughts, and an SL environment and a 3D multiuser virtual environment can have highly positive effects on enhancing foreign language education due to their accessibility, flexibility, and effectiveness. Researchers, however, should still focus on conducting future training sessions for academics and students. For example, Dwivedi et al. (2022) highlighted the positive effects of Metaverse, VR, and AI applications on the engagement and performance of European secondary school students. Personally, this case study revealed that the immersive nature of these technologies can significantly support language learning by increasing students' motivation to learn modern foreign languages. That can be a crucial factor for traditional learning due to its accessibility, flexibility and efficiency. However, it is essential to acknowledge that while these immersive technologies offer incredible advantages, they also present challenges.

Table 2 summarises the benefits and challenges of adopting Metaverse, AI and SL technologies in new language education.

RQ2: What are the privacy, ethical and social concerns of using Metaverse, SL and AI environments for learning and teaching new languages in higher education?

As the population participating in the acquisition of foreign languages continues to grow, immersive technologies such as the Metaverse, AI, and SL present valuable resources to enhance instruction and facilitate learning in environments with constrained resources. However, the incorporation of these technologies into higher education also engenders significant concerns pertaining to privacy, ethics, and social interaction.

Table 2: Benefits and challenges of adopting Metaverse, AI and SL technologies in new language. education.

Aspects	Benefits	Challenges
AI and Chatbot Adoption	Offers personalised assistance, immediate feedback, and innovative approaches to language instruction. Reshapes language education, making it more dynamic, stimulating, flexible, attractive and exciting.	Computer programming skills, simulation of human intelligence and technical issues. Limited availability of chatbots, cost complexities and technical issues
SL Platforms in Language Education	Creates engaging, flexible, and existing atmospheres, revolutionising language education. Boosts students' confidence and proficiency, facilitates immersive learning.	Navigating complexities, incorporating technologies efficiently, and overcoming potential obstacles. Also, challenges include identifying participants, overcoming technical limitations, and addressing potential obstacles.
3D Multimodal Resources in SL Environment	Offers visual and linguistic assistance while promoting language acquisition missions.	Technical limitations, ensuring participant identification, and solving potential learning challenges.
3D Muve Platform	Triggers motivation, improves verbal and oral skills and decreases anxiety.	Including adapting to new technology, workload management, and avoiding potential future challenges.
Metaverse environments	Provides a promising approach to new language education, striking a balance between practical practices and immersive technologies. Leads to improved students' fluency, awareness, engagement, motivation, and attention. Solve some issues like depression and disability. Enhances engagement and performance, supports language learning.	Adapting to virtual environments, managing workload and potential future technical challenges. Technical, social, privacy, and ethical issues. Accessibility, flexibility and efficiency, along with acknowledging potential challenges.
VR Creation and Technological Readiness	Facilitates transformative experiences and supports the readiness of pre-service teachers.	Technological readiness, managing workload, and addressing potential future technical challenges.

Addressing these concerns requires a comprehensive strategy that encompasses the establishment of explicit privacy guidelines and the promotion of cultural sensitivity within virtual environments. A robust commitment to equity, inclusiveness, and ethical practices is essential for the responsible adoption of these technologies. Gay and Gervais (2025) suggested that to avoid such adverse effects, the universities should establish a formal feedback

mechanism for immersive technologies. This would assist in ensuring that their policies and practices remain aligned with current applications as well as the rapid development of these innovative technologies in terms of flexibility and sophistication.

According to Tegoan et al. (2024), immersive technologies have significantly contributed to effective language acquisition. However, since these platforms rely on sensitive data from both educators and students, it is imperative to ensure the safeguarding of data security and user privacy. Upholding ethical data practices fosters trust and promotes the sustainable utilisation of these advanced tools in language education.

In accordance with student privacy and data security protocols, students frequently disclose sensitive information and personal data on virtual platforms, including their names, academic histories, preferences, and communication styles. Such data may be susceptible to misuse or unauthorised exposure by unpermitted entities (Kamenskih, 2022). To mitigate this concern, educational institutions must implement robust data protection policies and provide training on cybersecurity measures (Acheampong et al., 2025). Acheampong et al. (2025) emphasised that secure authentication processes, encryption methodologies, and privacy-centric practices are essential for safeguarding both teacher and student data. For instance, authenticity can be verified through the use of digital signatures, while hash function algorithms ensure the integrity of data (Acheampong et al., 2025). Both educators and students should receive training on best practices for managing personal information within virtual environments. Furthermore, Dwivedi et al. (2022) and Hwang and Chien (2022) underscored that the adoption of new technologies in language education introduces novel privacy challenges. Interaction among students in these settings may be susceptible to exploitation, thereby underscoring the necessity of fostering trust through effective data management strategies. Kamenskih (2022) further cautions that incidents of personal hacking and data breaches must be minimised in immersive educational environments.

Teachers also face privacy concerns in immersive environments, as they frequently have access to sensitive student data, such as feedback and performance analytics. To maintain ethical standards, teachers need to handle this information judiciously, ensuring that it remains confidential and is not subject to unauthorised access or improper utilisation. Moreover, the challenges associated with the adoption of information technology into innovative educational virtual environments often place accountability not on the developers but rather on government oversight, particularly through accreditation and certification processes (Kamenskih, 2022). Consequently, educators should only access data pertinent to their teaching roles within the institution to avert potential privacy infringements. Canto et al. (2013) explored the complexities inherent in utilising platforms such as SL in language education, asserting that the establishment of clear privacy guidelines and the implementation of secure tools are vital for the management of sensitive information pertinent to both students and educators.

Rani (2022) elucidated that AI-powered chatbots utilised in language education collect data from student interactions, which raises significant concerns regarding data sharing and the potential for misuse. To ensure transparency in data collection and analysis, it is imperative that stringent privacy protocols be implemented. Additionally, ethical guidelines are essential to safeguard student privacy while simultaneously reaping the benefits of the personalised feedback and support these tools can provide. When adequately secured, AI tools have the potential to transform language education by offering grammar checks, writing assistance, and adaptive learning experiences. Moreover, the incorporation of Metaverse and SL technologies introduces cultural and social concerns. Although these platforms present numerous advantages for language education, they can also foster negative behaviours such as harassment, bullying, or cultural misunderstandings. To cultivate respectful and inclusive environments, educators are required to adopt culturally responsive teaching practices and undergo training in cultural dynamics (Hunter, 2015). Virtual classrooms should integrate diverse cultural perspectives, community guidelines, and moderation tools to preserve a safe and inclusive learning atmosphere. When properly managed, these intelligent technologies can bridge cultural divides and foster global understanding.

Another significant challenge pertains to communication issues and the apprehension surrounding negative criticism. Delayed feedback or harsh evaluations can adversely affect student motivation and participation. Nevertheless, immersive tools such as the Metaverse, SL, and AI can deliver real-time, supportive feedback, thereby alleviating anxiety and enhancing engagement. Canals (2020) emphasised the need to address the technical, ethical, and user adaptation challenges within virtual classrooms. Similarly, Garcia and da Silva (2018) recognise the benefits of SL and avatars while also acknowledging concerns related to negative feedback.

In conclusion, while immersive technologies present immense potential for language education, their effective utilisation in higher education necessitates meticulous attention to privacy, ethical responsibilities, and inclusive design.

Q3: What are the future directions of Metaverse, SL and AI environments for learning and teaching second languages in higher education?

Future developments will likely focus on building Metaverse replicas of educational institutions to enhance flexibility, accessibility, and engagement in education. Sami et al. (2023) explored how digital replicas of schools and universities within the Metaverse can break geographical and logistical barriers to language learning. These technologies allow students to engage in real-time discussions and collaborate using a wide range of immersive tools and resources. The immersive learning environment provides realistic simulations, making language learning more effective and contextual. Visual aids, multimedia elements, and interactive virtual experiences can enhance the understanding of complex grammar and language structure. Virtual simulations also benefit educators by saving time and effort, which enables them to

manage their classes efficiently while delivering realistic and meaningful instruction. These environments are particularly beneficial for remote learners who are unable to attend in-person sessions.

The adoption of innovative technologies, like lifelogging applications integrated with AI, IoT, and blockchain, offers a personalised and data-driven approach to language education. Tlili et al. (2022) emphasised that these technologies can track learner progress, generate actionable learning insights, and ultimately improve student outcomes. However, further research is needed to explore how immersive technologies can more effectively support learners with disabilities by developing inclusive and accessible virtual environments.

To facilitate the successful adoption of these immersive tools into teaching practices, both synchronous and asynchronous training sessions should be provided for educators. Promoting collaboration in virtual settings can also foster student engagement and teamwork, which are essential for completing projects and tasks in real-time. This builds a sense of community and increases the likelihood of successful smart technology adoption.

Conclusion

The Metaverse, AI, and SL environments represent a significant frontier in the evolution of language education, which offers unprecedented opportunities to adopt digital and physical realms within multiuser immersive settings. This systematic review aims to highlight both benefits and challenges and provide solutions to educational obstacles, while also outlining future directions for their adoption in language higher education contexts. The synthesis of 130 studies demonstrates that the use of Metaverse, AI, and SL technologies in language education is reshaping the accessibility and availability of teaching and learning resources, thereby transforming pedagogical practices. The findings show that the benefits of using Metaverse, AI, and SL technologies include overcoming traditional limitations of language instruction, enhancing learner awareness and language acquisition, increasing motivation and engagement, supporting fluency development, and encouraging active participation. Furthermore, these immersive technologies have been shown to enhance teaching strategies and establish ethical frameworks that support both educators and learners. However, several barriers hinder the use of these technologies, including technical constraints, limited expertise in developing and utilising immersive 3D platforms, and challenges in managing virtual classrooms which collectively limit their overall potential. In addition, insufficient training prevents students from fully realising the benefits of these innovative tools for second language acquisition. Despite these obstacles, the findings underscore the significant promise of immersive technologies in advancing language education. By addressing the identified challenges through targeted training, institutional support, and robust implementation strategies, educators, policymakers, and researchers can maximise the transformative potential of the Metaverse, AI, and SL environments. Ultimately, this review provides critical insights to guide researchers, academics and institutions in navigating the dynamic landscape of digital language education and harnessing immersive technologies for effective, equitable, and innovative learning and teaching experiences. One limitation of this study is that the information and analysis are limited to existing literature focused solely on the Metaverse, AI, and SL environments. Additionally, the scope of the research is restricted to higher education contexts. Future studies should explore the application of alternative technologies across other educational levels, such as primary and secondary education, to broaden the understanding of their potential impact.

Practical implications

From a practical perspective, the systematic review has examined the benefits and challenges of Metaverse, SL, and AI technologies in the realm of language learning and teaching. This paper outlines an avenue for conducting further research that may lead to the development of teaching procedures and learning experiences by implementing these new technologies. This systematic review provided insights into the challenges of implementing Metaverse, SL, and AI technologies for learning and teaching new languages. Before adopting the Metaverse, SL, and AI technologies, it is essential to address the technical issues that arise when using Metaverse software during the learning process and make them more affordable and accessible for users to leverage the benefits of these immersive technologies. Secondly, this paper highlighted the essential role of the Metaverse, SL, and AI technologies in addressing traditional learning and ethical challenges. The study described continuous learning opportunities that were not limited by time or space. With AI tutors, the Metaverse technology provides students with direct feedback, immediate assistance, and prompts to enhance training and learning efficiency. The results can be utilised by education providers, policymakers, language academics, and teachers to develop effective mechanisms, such as needs assessment frameworks, digital readiness evaluations, and pedagogical integration models, for understanding the challenges of using new virtual technologies. They can also inform practical strategies, such as targeted professional development programs, the incorporation of immersive tools into language curricula, and the design of adaptive, learner-centred virtual environments to enhance future teaching and learning experiences.

Recommendations

The following recommendations are suggested based on the findings of this study. First, it is important for higher education providers to provide a comprehensive training for language academics in using Metaverse, AI, and virtual environments effectively. Second, higher education providers need to ensure reliable internet connectivity and hardware are readily available for both academics and learners for immersive environments like Second Life and Metaverse platforms. Third, academics should collect student feedback regularly to evaluate effectiveness and improve implementation of the immersive technologies. Fourth, higher education providers must ensure that platforms

comply with institutional and legal data protection policies, especially regarding privacy and data concerns. Fifth, these providers should also focus on accessibility and equity for ensuring that all students have the resources and support to participate fully.

Future research opportunities

Future studies could focus on practical concerns, like privacy, self-sufficiency, technology-related anxiety, user satisfaction, security, and broader ethical considerations. When using immersive technologies, it is vital to address ethical dilemmas, particularly those related to privacy, data security and fairness, to create a safe and supportive immersive education environment. Future research should build on the findings of this review, particularly the identified benefits and challenges of immersive and AI-driven technologies, by employing more standardised reporting practices and exploring underexplored areas, especially accessibility for learners with disabilities to ensure that immersive and AI-mediated environments promote inclusivity and equitable participation. This study has highlighted various challenges associated with the implementation of Metaverse, SL, and AI technologies in new language education, indicating critical domains for future inquiry. Further investigation is essential to understand the most effective strategies for training educators and students to collaborate within immersive environments. Additionally, research should explore the design and evaluation of Metaverse-based applications that improve accessibility, affordability, and user-friendliness in higher education. Moreover, there is a necessity to examine the long-term pedagogical impacts of these technologies on language acquisition and learner engagement.

References

Acheampong, R., Popovici, D. M., Balan, T., Rekeraho, A., & Ramos, M. S. (2025). Enhancing security and authenticity in immersive environments. *Information, 16*(3), 191.

Al-Barakat, A. A., Al Ali, R. M., Bataineh, R. F., & Zaher, A. M. (2025). Unlocking language: EFL teachers' perspectives on constructivist philosophy in practice. *XLinguae,* 18-32.

Alfadil, M. (2020). Effectiveness of virtual reality game in foreign language vocabulary acquisition. *Computers & Education, 153*, 103893.

Baek, J., & Lee, C. (2021). Effects of mobile-assisted blended learning on university students' English speaking proficiency in Korea. *The Journal of Asia TEFL, 4*, 1266-1284.

Basaran, B. (2024). Rethinking AI in education: A comparative study of custom and external systems. *2024 6th International Workshop on Artificial Intelligence and Education (WAIE), Tokyo, Japan,* 16-28.

Bower, M. (2017). Designing for learning using virtual worlds. Design of Technology-Enhanced Learning. *Emerald Publishing Limited, Bingley,* 305-364.

Canals, L. (2020). The effects of virtual exchanges on oral skills and motivation. *Language Learning & Technology, 24*(3), 103-119.

Canto, S., Jauregi, K., & Bergh, H. (2013). Integrating cross-cultural interaction through video-communication and virtual worlds in foreign language teaching programs: Is there an added value? *ReCALL, 1,* 105-121.

Chau, N. T. H., Nguyen, T. H. T., & Truong, V. L. (2025). The rise of artificial intelligence: The impact of artificial intelligence on language learning. *The 14th International Conference on Educational and Information Technology,* 58-62.

Chen, J. C. (2016). The crossroads of English language learners, task-based instruction, and 3D multi-user virtual learning in SL. *Computers & Education, 102*, 152-17.

Cheng, R., Wu, N., Chen, S., & Han, B. (2022). Will metaverse be next G internet? Vision, hype, and reality. *IEEE Network, 36*(5), 197-204.

Dahan, N., Al-Razgan, M., Al-Laith, A., Alsoufi, M., Al-Asaly, M., & Alfakih, T. (2022). Metaverse framework: A case study on e-learning environment (ELEM). *Electronics, 10,* 1616.

Dalsgaard, C. (2006). Social software: E-learning beyond learning management systems, *European Journal of Open. Distance and E-Learning*, 1027-5207.

Daud, W., Wong, K., Ghani, M., & Ramli, S. (2021). Gender differences in learning Arabic language proficiency via m-learning among Malaysia university students. *Journal of Language and Linguistic Studies, 17*, 1069-1082.

Dawilai, S., Yooyativong, T., & Kamyod, C. (2025). Proposing ChatGPT as a transformative tool for enhancing ESL speaking and listening skills: Bridging research gaps in Thai education. *2025 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering, Nan, Thailand,* 254-258.

Dong, Y., Yu, X., Alharbi, A., & Ahmad, S. (2022). AI-based production and application of English multimode online reading using a multi-criteria decision support system. *Soft Computing*, 1-11.

Dooly, M., & Sadler, R. (2013). Filling in the gaps: Linking theory and practice through telecollaboration in teacher education. *ReCALL, 1,* 4-29.

Dwivedi, Y., Hughes, L., Baabdullah, A., Ribeiro-Navarrete, S., Giannakis, M., Al-Debei, M., Dennehy, D., Metri, B., Buhalis, D., Cheung, C., & Conboy, K. (2022). Metaverse beyond the hype: Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management, 66,* 102542.

El-Zeiny, M. E., Faqeeh, M. H., Almahdawi, A., Abdo, M. A. F., Mostafa, I., & Alahbabi, A. (2023). Enhancing non-native speakers' pronunciation: AI-driven storytelling with Arabic

emphatic consonants. *2023 Tenth International Conference on Social Networks Analysis, Management and Security, Abu Dhabi, United Arab Emirates,* 1-7.

Felix, U. (2003). Pedagogy on the line: Identifying and closing the missing links. In U. Felix (Ed.), *Language learning online. towards best practice,* 147-170. Lisse: Swets & Zelinger.

Garcia, M., & da Silva, P. (2018). Acquisition of language and intercultural competences in tourism and hospitality studies through active experimentation in second life. *Teaching English with Technology, 18*, 69-92.

Goda, Y., Yamada, M., Matsukawa, H., Hata, K., & Yasunami, S. (2014). Conversation with a chatbot before an online EFL group discussion and the effects on critical thinking. *The Journal of Information and Systems in Education, 1*, 1-7.

Gay, E. H. T., & Gervais, G. C. (2025). Investigating students' perspectives on the integration of generative artificial intelligence in university curricula and assessments. *Journal of Applied Learning and Teaching, 8*(2), 34-44. https://doi.org/10.37074/jalt.2025.8.S2.2

Grant, S., Huang, H., & Pasfield-Neofitou, S. (2014). The authenticity-anxiety paradox: The quest for authentic second language communication and reduced foreign language anxiety in virtual environments. *Procedia Technology, 13,* 23-32.

Haristiani, N. (2019). AI (AI) chatbot as language learning medium: An inquiry. 2019. *Journal of Physics: Conference Series, 1387*(1), 01. IOP Publishing.

Hunter, T. C. (2015). Practising culturally relevant pedagogy: A literature review of classroom implementation. *BU Journal of Graduate Studies in Education, 7*(2), 76-84.

Hwang, G., & Chien, S. (2022). Definition, roles, and potential research issues of the Metaverse in education: An AI perspective. *Computers and Education: AI, 3*, 100082.

Hwang, G., Xie, H., Wah, B., & Gasevic, D. (2020). Vision, challenges, roles and research issues of AI in education. *Computers and Education: AI, 1*,100001.

Ibanez, M., Garcia, J., Galan, S., Maroto, D., Morillo, D., & Kloos, C. (2011). Design and implementation of a 3D multi-user virtual world for language learning. *Educational Technology & Society, 4*, 2-10.

Isgor Simsek, E., & Baltaci, S. (2024). A systematic examination of metaverse technologies, with emphasis on second life as a pedagogical instrument. *Journal of Computers in Education,* 1-30.

Jeon, J., Lee, S., & Choe, H. (2022). Enhancing EFL pre-service teachers' affordance noticing and utilising with the synthesis of qualitative evidence strategies: An exploratory study of a customizable virtual environment platform. *Computers & Education, 190*, 104620.

Kamenskih, A. (2022). The analysis of security and privacy risks in smart education environments. *Journal of Smart Cities and Society, 1*,17-29.

Kim, N. (2019). A study on the use of AI chatbots for improving English grammar skills. *Journal of Digital Convergence, 8*, 37-46.

Kim, H. S., Cha, Y., & Kim, N. Y. (2021). Effects of AI chatbots on EFL students' communication skills. *Korean Journal of English Language and Linguistics, 21*, 712-734.

Kovacs, C. (2016). *Communication in a MUVE: An exploratory case study of teacher interactional devices in second life* (Doctoral dissertation, Universitat de Barcelona).

Lee, H., & Hwang, Y. (2022). Technology-enhanced education through VR-making and metaverse-linking to foster teacher readiness and sustainable learning. *Sustainability, 14*, 4786.

Lee, K., & Kim, B. (2016). Cross space: The exploration of SNS-based writing activities in a multimodal learning environment. *Education, Technology & Society, 19*, 57-76.

Lee, S. M. (2023). Second language learning through an emergent narrative in a narrative-rich customizable metaverse platform. *IEEE Transactions on Learning Technologies, 16*(6), 1071-1081.

Liou, H. (2012). The roles of SL in a college computer-assisted language learning (CALL) course in Taiwan, ROC. *Computer Assisted Language Learning 4*, 365-382.

Liu, J., Sihes, A. J. B., & Lu, Y. (2025). How do generative artificial intelligence (AI) tools and large language models (LLMs) influence language learners' critical thinking in EFL education? A systematic review. *Smart Learning. Environment, 12*(1), 48.

Mayormente, M. D., Subhashini, R., Mayormente, M. D., Lawrance, J. C., Rengarajan, M., & Bala, B. K. (2024). Design and evaluation of a multilingual chatbot for interactive English language learning. *2024 International Conference on Data Science and Network Security, Tiptur, India,* 1-6.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.

Molka-Danielsen, J., Richardson, D., Deutschmann, M., & Carter, B. (2007). Teaching languages in a virtual world. *NOKOBIT Proceedings 2007*.

Mystakidis, S. (2022). Metaverse. *Encyclopedia, 1*, 486-497.

Ng, P. H., Har, F. T., Tai, K. S., Leung, W. C., Chen, P. Q., Zhou, L., Lam, J. K., Law, H. K., Li, C., Lam, Y. Y. & Li, Q. (2024). Gamified constructivist teaching in metaverse: Revolutionizing language learning in university via an immersive experience. *2024 IEEE International Conference on Metaverse Computing, Networking, and Applications, Hong Kong, China,* 151-157.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M.,

Akl, E. A., Brennan, S. E., & Chou, R. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ,* 372.

Pasfield-Neofitou, S., Huang, H., & Grant, S. (2015). Lost in SL: Virtual embodiment and language learning via multimodal communication. *Educational Technology Research and Development, 63*, 709-726.

Peterson, M. (2012). EFL learner collaborative interaction in SL. *ReCALL, 1,* 20-39.

Prabakaran, S., Patrick, H., & Kareem, J. (2025). Enhancing English language proficiency and digital literacy through metaverse-based learning: A mixed-methods study in higher education. *Journal of Information Technology Education: Research, 24*, 101-115.

Pradhan, R., Khan, S. A., Jegu, A., Kavitha, P., Rautrao, R. R., & Ponni Valavan, M. (2024). Exploring the intersection of technology and education: Artificial intelligence in language learning and communication. *2024 International Conference on Intelligent Systems and Advanced Applications, Pune, India*, 1-6.

Prasad, V., Balavivekanandhan, A., Bordoloi, D., Mythili, M., & Alphonse, F. R. (2024). AI-enhanced deep learning techniques for evaluating progress in English L2 learners. *2024 8th International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud), Kirtipur, Nepal, 1941-1947*.

Rani, S. (2022). The impact of AI voice bots and chatbots on personalized learning in education: Opportunities, challenges, and future trends. *IJCRT, 10*.

Regmi, K., & Jones, L. (2020). A systematic review of the factors, enablers and barriers-affecting e-learning in health sciences education. *BMC Medical Education, 20*, 1-18.

Salmon, G. (2009). The future for (second) life and learning. *British Journal of Educational Technology 3*, 526-538.

Sami, H., Hammoud, A., Arafeh, M., Wazzeh, M., Arisdakessian, S., Chahoud, M., Wehbi, O., Ajaj, M., Mourad, A., Otrok, H., & Wahab, O. A. (2023). *The metaverse: Survey, trends, novel pipeline ecosystem & future directions*. arXiv preprint arXiv:2304.09240.

Saritas, M., & Topraklikoglu, K. (2022). Systematic literature review on the use of metaverse in education. *International Journal of Technology in Education, 5*(4), 586-607.

Shao, S., Alharir, S., Hariri, S., Satam, P., Shiri, S., & Mbarki, A. (2022). AI-based Arabic language and speech tutor. *2022 IEEE/ACS 19th International Conference on Computer Systems and Applications, Abu Dhabi, United Arab Emirates,* 1-8.

Suo, W. (2024). An artificial intelligence based diagnosis model for evaluation of college English teaching quality. *The Second International Conference on Data Science and Information System, Hassan, India,* 1-4.

Tegoan, N., Grandhi, S., Wibowo, S., & Yang, R. (2024). Applying extended reality technology in teaching new languages: A study from academics' perspective in Australian universities. *The 25th International Arab Conference on Information Technology (ACIT),* 1-6, IEEE.

Tegoan, N., Wibowo, S., & Grandhi, S. (2021). Application of the extended reality technology for teaching new languages: A systematic review. *Applied Sciences, 11*(23), 1-16.

Tlili, A., Huang, R., Shehata, B., Liu, D., Zhao, J., Metwally, A. H. S., Wang, H., Denden, M., Bozkurt, A., Lee, L. H., & Beyoglu, D. (2022). Is metaverse in education a blessing or a curse: A combined content and bibliometric analysis. *Smart Learning Environments, 9*(1), 1-31.

Tuncer, C., & Simsek, I. (2015). The use of 3d virtual learning environments in training foreign language pre-service teachers. *Turkish Online Journal of Distance Education, 4,* 114-124.

Ushioda, E. (2011). Language learning motivation, self and identity: Current theoretical perspectives. *Computer Assisted Language Learning 3*, 199-210.

Wang, A. (2015). Facilitating participation: Teacher roles in a multiuser virtual learning environment. *Language Learning & Technology 2,* 156-176.

Wang, S., Iwata J., & Okamoto, M. (2024). Incorporating ChatGPT in English classrooms: A case study. *2024 12th International Conference on Information and Education Technology, Yamaguchi, Japan*, 203-207.

Wen, Y., Wang, Z., & Guo, X. (2025). Trends and applications of AI in immersive learning environments: A systematic review of empirical research. *Interactive Learning Environments,* 1-19.

Whiting, P., Savović, J., Higgins, J. P., Caldwell, D. M., Reeves, B. C., Shea, B., Davies, P., Kleijnen, J., Churchill, R., & ROBIS group. (2016). ROBIS: A new tool to assess risk of bias in systematic reviews was developed. *Journal of Clinical Epidemiology, 69*, 225–234. https://doi.org/10.1016/j.jclinepi.2015.06.005

Williams, M., Bussing, S., Cabrol, E., Boyle, E., & Tran, N. (2019). Mixed reality deictic gesture for multi-modal robot communication. *The 14th ACM/IEEE Conference on Human-Robot Interaction,* 191-201.

Wolfswinkel, J., Furtmueller, E., & Wilderom, C. (2013). using grounded theory as a method for rigorously reviewing literature. *European Journal of Information Systems, 22*. 10.1057/ejis.2011.51.

Zhou, J. (2020). Design of AI-based self-learning platform for college English listening. *2020 2nd International Conference on Machine Learning, Big Data and Business Intelligence (MLBDBI), Taiyuan, China*, 544-547.

Zhou, Y., & Divekar, R. (2025). Immersive, task-based language learning through XR and AI: From design thinking to deployment. *TechTrends, 69,* 427-446.

Zhai, C., & Wibowo, S. (2023). A systematic review on artificial intelligence dialogue systems for enhancing English as foreign language students' interactional competence in the university. *Computers & Education: Artificial Intelligence, 4*, 1-26.

Zhai, C., Wibowo, S., & Li, L. D. (2024). Evaluating the AI dialogue system's intercultural, humorous, and empathetic dimensions in English language learning: A case study. *Computers and Education: Artificial Intelligence, 7*, 2024.