Exploring the Potential of Metaverse-Based Platforms for Enhancing English as a Foreign Language (EFL) Learning: A Comprehensive Systematic Review

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***Abstract*—Metaverse technology introduces a new dimension to education, offering continuous and sustainable learning experiences. With its immersive, multimodal interactions, the Edu-Metaverse holds promise for English as a Foreign Language (EFL) learning. As higher education moves towards digital transformation, the exploration of Metaverse technology's applications in EFL teaching becomes crucial. This study conducts a systematic review of the Metaverse in English language learning, emphasizing its integration with traditional education, effective pedagogical approaches, the diversity of Metaverse types in EFL learning, and challenges linked with Metaverse-based platforms in EFL education. The findings highlight the potential of Metaverse learning environments to enhance academic achievement while addressing key research questions. However, the review also recognizes its limitations and outlines directions for future research, offering valuable insights for educators and researchers interested in utilizing Metaverse platforms for EFL instruction.**

***Keywords*—Metaverse, English as a Foreign Language (EFL) learning, immersive virtual environment**

I. Introduction

In 2021, the concept of the Metaverse became a significant topic of discussion. According to Chen [1], the term "Metaverse" is a blend of "meta," meaning beyond, and "universe," which refers to a virtual world. The Metaverse is a virtual space that expands upon the physical world, incorporating various advanced technologies and elements from social media. Initially introduced in Neal Stephenson's 1992 novel, "Snow Crash," the concept has gone through four major transitions: from text-based interactive games to virtual open worlds, massively multiplayer online games (MMOGs), and immersive environments on smartphones and wearable devices, culminating in today's Metaverse [2]. As virtual reality and related technologies advance, the Metaverse has evolved from an abstract concept into a tangible reality [3, 4].

The Metaverse is distinguished by its interactivity, embodiment, and persistence. Lee has pointed out that it offers a new range of possibilities and challenges impacting various facets of work, life, and entertainment [2]. Though still in its infancy, the Metaverse holds boundless potential for educational applications. It can offer students a diverse, rich, and authentic learning experience while providing teachers with innovative, dynamic teaching methods [5–7].

The merging of traditional education with the internet has become a defining feature of modern education. However, research into the efficacy of online education has produced inconsistent findings concerning authenticity, social presence, and the overall remote learning experience [8–10]. Effective language learning is context-based and relies on situational learning within a discourse community, where interaction plays a vital role in language development [11]. The importance of context in EFL learning is pivotal. Regrettably, traditional EFL classrooms often focus on repetitive practice, rote memorisation, and exercises that lack real-world context [12, 13], making EFL learning uninspiring, inauthentic, and demotivating for students [14].

Addressing these challenges, the Metaverse has emerged as an alternative space for EFL learning. In the Metaverse, learners can engage in virtual scenarios, gaining valuable language practice and skill enhancement. Wang et al. [15] describe the Metaverse as "a network of 3D virtual worlds that fosters social connections among users, allowing them to engage in activities that simulate real-life situations." Hence, the Metaverse can provide realistic contexts for second language learning, fostering meaningful educational environments [2, 16].

The integration of the Metaverse with EFL education is opening up new and thrilling opportunities. It establishes an independent 3D learning environment marked by interactivity, immersiveness, diversity, and the elimination of temporal and spatial barriers. The Metaverse holds significant promise for foreign language learning, particularly because it encourages social interaction, thereby enhancing effective communication and engagement [17]. Recent research by Guo and Gao [18], along with Hwang *et al*. [19], highlights the Metaverse's ability to amplify students' sense of interaction, immersion, and cognition. Education stands as a promising area for Metaverse development, encompassing virtual classrooms, laboratories, cultural exploration, and language learning. Students can engage in an incredibly creative and interactive learning environment, interacting with peers and virtual characters to improve their language skills and access diverse learning opportunities. Teachers, meanwhile, can employ flexible, interactive, and vivid teaching methodologies within the Metaverse, thereby promoting cultural exchange and broadening students' global perspectives [20].

Recently, the Metaverse has garnered attention as a potential tool for enriching educational experiences. Numerous educational institutions have explored its integration into various disciplines, such as engineering and STEM education [21]. However, there is relatively limited focus on integrating the Metaverse into English as a Foreign

Language (EFL) education. While some experimental articles have discussed its use in EFL learning, comprehensive systematic reviews examining its application in this area are notably lacking. Therefore, a thorough investigation into the use of the Metaverse in English language education is essential to fully understand its potential benefits and challenges.

While numerous review articles have explored the use of the Metaverse in EFL learning, most have primarily focused on evaluating the effectiveness of Metaverse-integrated EFL learning in terms of boosting learner engagement and academic outcomes. These studies frequently employ bibliographic and content analysis techniques [22]. Alternatively, some reviews have zeroed in on specific Metaverse platforms like Roblox and holography [23, 24], conducted cross-country comparative analyses [25], or analyzed the benefits, potentials, and risks of incorporating the Metaverse into EFL learning [26].

However, there is a noticeable gap in literature concerning the integration of the Metaverse within the framework of curriculum design. Curriculum design plays a pivotal role when introducing a new learning and teaching environment, particularly when incorporating a technology-rich space like the Metaverse. Therefore, it becomes essential to investigate the practical application of the Metaverse in curriculum development and to formulate a systematic framework that assists educators in effectively integrating the Metaverse into their teaching methodologies.

To ensure the successful implementation of Metaverse-based EFL education, several critical questions need to be addressed:

RQ 1) How has the Metaverse been integrated into curriculum design?

RQ 2) What pedagogical strategies and instructional approaches have been employed in Metaverse-based EFL learning?

RQ 3) What types of Metaverse platforms have been utilized in EFL learning?

RQ 4) What challenges arise when employing Metaverse-based platforms in EFL education?

By addressing these questions, educators and researchers can gain valuable insights into the effective use of the Metaverse in EFL learning. This ensures that the Metaverse not only enhances the learning experience but also empowers students to thrive in an interconnected world.

II. Methods

A. Search Strategy and Parameters

This study conducted a systematic literature review focusing on the use of the Metaverse in the context of English as a Foreign Language (EFL) teaching. The primary objective was to gauge the extent of learner engagement, learning outcomes, and challenges faced when employing Metaverse platforms in EFL education. The search process covered prominent databases including Web of Science, Scopus, EBSCO, and JSTOR, and was supplemented by Google Scholar to capture the field's latest contributions. Research articles and review articles served as the core sources for this review, with the search period spanning from 2019 to 2023 to ensure a comprehensive survey of the most current literature.

The search methodology was carefully crafted to ensure a systematic and precise approach. It involved formulating a comprehensive search equation designed to yield accurate and relevant results. This equation included specific keywords and extraction methods, enabling a thorough examination of titles, abstracts, and keyword sections within the selected databases. The chosen keywords for the search query were: "EFL learning," "English teaching," "English learning," "second language education," and "Metaverse." These keywords effectively capture the essence of our research topic, allowing us to identify articles and studies that directly contribute to our understanding. The keywords were slightly adjusted in different database searches to optimize the retrieval of results, and the specific search terms are presented as indicated in Table 1. To further refine the search results, certain constraints were applied: Articles needed to be in English and published within the last five years, spanning from 2019 to 2023. This choice was made because English-language literature is generally more globally accessible and draws from a broader range of sources.

Specifically, both research articles and review articles were retrieved in the search to provide a comprehensive overview of the current state of the field. The research date was set to September 12, 2023, to ensure the inclusion of the most recent and up-to-date research. The scope of the articles was confined to the fields of Education, Linguistics, and Social Science. Additionally, during the searches, criteria were incorporated to exclude non-peer-reviewed articles, thereby ensuring the quality of the articles. Table 1 offers a detailed breakdown of the number of findings obtained from each database, providing transparency in the search process and its outcomes.

Table 1. Number of findings in each database

Source	Key words	Number of results
Web of science	(EFL learning OR English teaching OR English learning OR Second language education) AND Metaverse (search for Abstract)	12
Scopus	EFL learning AND Metaverse	4
EBSCO	EFL learning AND Metaverse (Limited to peer-reviewed academic journals)	77
JSTOR	(English learning OR English education) AND Metaverse (Limited to academic journals)	6
Taylor & Francis Online	(EFL learning OR English teaching OR English learning OR Second language education) AND Metaverse	5
SAGE	(EFL learning OR English teaching OR English education) AND Metaverse	2
Proquest	EFL learning AND Metaverse (Limited to academic journals)	22
Wiley Library Online	EFL learning AND Metaverse	1
Google	(EFL learning OR English teaching OR English education) AND Metaverse filetype: PDF	94

B. Information Filtering

Following the guidelines of the PRISMA protocol, we

implemented a systematic search strategy. The search equation and predefined time frame yielded 129 publications from databases, along with an additional 94 publications identified with full text available through Google. To further refine our selection, a preliminary screening process was initiated, applying stringent criteria that encompassed factors such as title, keywords, language, and abstract. This rigorous assessment involved the scrutiny of two researchers to ensure both thoroughness and consistency in the selection process. This initial review identified 42 publications that merited further comprehensive analysis.

Subsequently, we conducted a full-text analysis to determine their eligibility. Our inclusion criteria stated that the studies must specifically address the utilization of the Metaverse in EFL teaching and be supported by empirical data. A total of 31 publications were carefully included. For a graphical representation of this literature inclusion and exclusion process, please refer to Fig. 1.

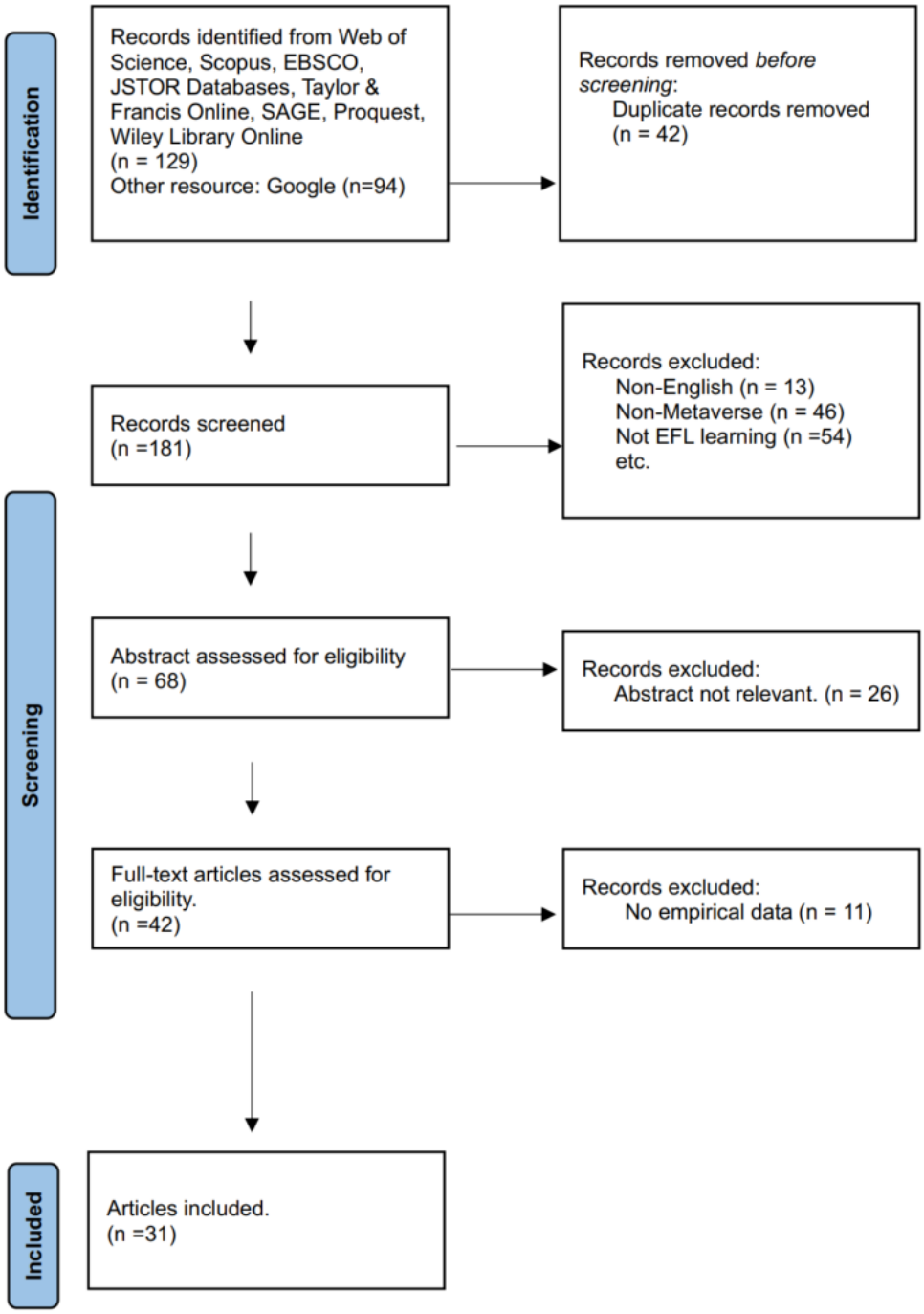

Fig. 1. A flowchart of the literature inclusion and exclusion based on the PRISMA protocol.

C. Review of Literature and Data Relationships

After the literature selection process, we carried out a comprehensive reading and analysis to understand the objectives and impacts of incorporating Metaverse platforms into EFL learning and teaching. To systematically analyze the collected data, we used thematic analysis, which enabled us to identify recurring themes and patterns across the selected studies. Additionally, we conducted theme analysis of the full text in alignment with the four research questions outlined earlier. The results of our data analysis are discussed in detail, offering insights into the potential advantages, limitations,

and directions for future research. In summary, the findings suggest that integrating Metaverse platforms into EFL teaching has the potential to enhance learner engagement, academic performance, and address pedagogical challenges.

III. Results and Discussion

The researchers employed clustering and mapping techniques in VOSviewer to validate their research questions [27]. VOSviewer is a software tool commonly used for analyzing bibliometric networks. It constructs networks of scientific journals, keywords, or terms through methods such as bibliographic coupling, co-authorship, co-occurrence, citation, or co-citation links [27]. VOSviewer can generate visual maps based on network data, examining research trends and hotspots among network and bibliographic database files [27]. In this research, we analyzed the co-occurrence of keywords from the search results, as shown in Fig. 2.

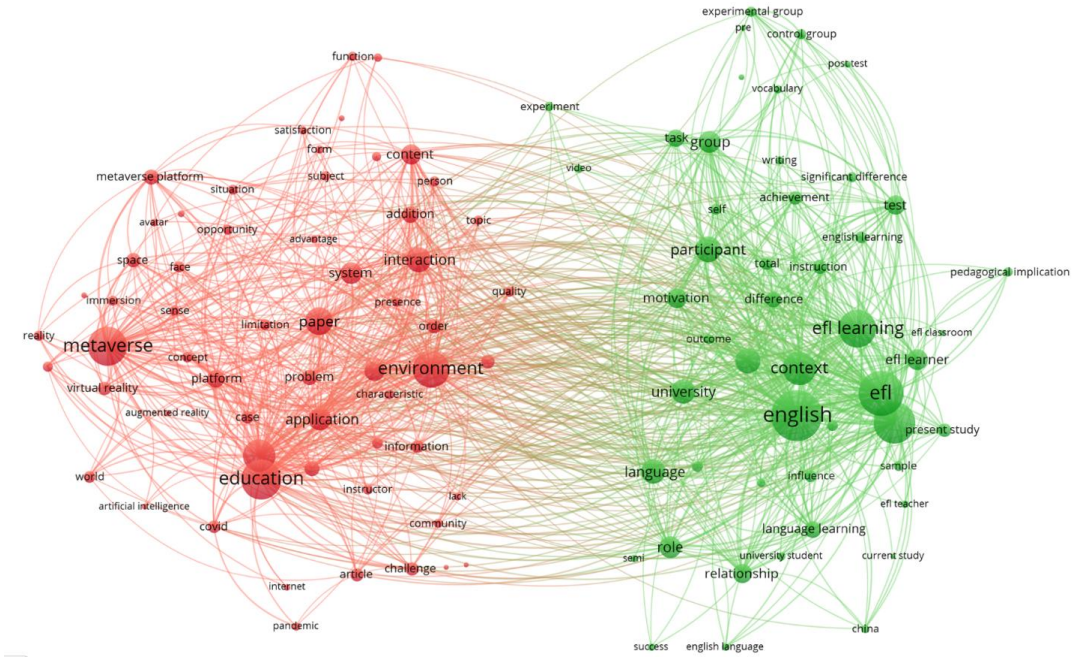

Fig. 2. Cooccurrence of key words related to Metaverse and EFL learning.

After tabulating the 31 articles, we found that all were published between 2022 and 2023. The geographical distribution of these articles was primarily concentrated in Asia and Europe, with the majority originating from South Korea and China. Regarding the Metaverse platforms used in these studies, Roblox, Immerse, Cospace Edu, ifland, Gather Town, OpenSimulator, and Frame VR were employed to varying extents. In general, this data offers valuable insights into the growing trend of using Metaverse platforms for educational purposes across diverse regions worldwide. However, further research and analysis are needed to develop a deeper understanding of how these platforms can be effectively integrated into the EFL curriculum and instruction.

A. RQ 1) How Has the Metaverse Been Integrated into Curriculum Design?

Research has shown that incorporating the Metaverse into EFL education enhances learner engagement [22, 28], promotes deeper and more meaningful learning experiences [29], encourages Social and Individualized Learning [19], and improves learning outcomes [18, 22, 30]. As a new and innovative learning environment, the integration of Metaverse technology into traditional teaching models holds significant importance in the field of education. Researchers have identified several areas where the Metaverse has the potential to revolutionize learning experiences.

Li and Yu emphasized adapting the curriculum through a blended learning approach using Metaverse-based environments, resource management for language learning tasks, and creating a virtual environment that encourages learning activities and community engagement [22]. This approach supplements traditional classroom instruction, providing learners with opportunities to engage in immersive virtual environments that complement their face-to-face learning experiences. Empirical studies underscore the importance of designing learning environments with game-like aspects for successful language learning and academic achievement [18, 29, 30]. Ji *et al*. suggested innovative educational practices in the Metaverse, such as diverse educational resources, support for various learning activities, and the establishment of educational settings like libraries, campuses, and classrooms [25].

Moreover, Çelik and Yangın Ersanlı proposed integrating augmented reality and gamification into the curriculum to enhance language learning outcomes and increase classroom engagement [30]. Shu and Gu highlighted the significance of incorporating e-learning platforms and multimedia resources, offering interactive activities, VR/AR courses, and audio/video resources to stimulate learners' interest and provide immersive experiences [29]. To ensure successful integration, teachers need to evaluate learners' activity patterns, level of immersion, and behavioral intentions in using the Metaverse [22]. By doing so, educators can create immersive learning contexts that leverage the potential of Metaverse-based environments [19]. Teachers should also consider coordinating teaching design, resource development

costs, and VR presentation effects to optimize the learning experience [31].

The combination of Metaverse technology with traditional teaching methods opens up innovative possibilities for education. By incorporating diverse resources, fostering engagement, and providing immersive experiences, educators create dynamic and effective learning environments that promote language learning and academic achievement.

B. RQ 2) What Pedagogical Strategies and Instructional Approaches Have Been Employed in Metaverse-Based EFL Learning?

In past studies, researchers have offered users an enhanced sense of autonomy and mastery within virtual realms. This allows individuals to immerse themselves in English virtual spaces that nurture profound levels of knowledge [18, 32]. Learners have the opportunity to construct their English knowledge and expertise in these virtual domains [28]. Furthermore, the integration of virtual reality technologies empowers learners to engage in real-time online communication, providing them with a potent tool for English learning [19, 33].

The educational metaverse is supported by constructivism theory and contextual learning theory. These theories promote students' active engagement, meaningful interactions, and collaborative learning within the virtual realm through their digital identities [34]. Grounded in these theories, the immersive, interactive, and visionary virtual intelligent learning environment offers new possibilities for EFL.

The metaverse provides a rich array of learning strategies that enhance its appeal in education. Within this metaverse-based learning environment, a diverse range of effective pedagogical strategies and instructional approaches are available. These include immersive and interactive scenarios [28, 29], personalized learning [24], gamification [35], embodied learning, contextualized teaching [22, 25, 34], and collaborative learning [18, 20, 34]. The integration of interactive and multimedia resources, along with immersive experiences, significantly contributes to the appeal of metaverse technologies for language learning.

Immersive learning in the metaverse-based environment offers learners extraordinary and captivating experiences that transcend traditional educational settings [22]. By immersing learners in interactive and lifelike virtual scenarios, it fosters deep engagement and active participation in the learning process. This heightened level of engagement goes beyond mere psychological presence, leading to a more profound sense of presence and involvement within the virtual environment [19, 28, 29]. The appeal of immersive learning lies in its ability to create a seamless and authentic learning experience. Learners can interact with virtual objects, navigate virtual spaces, and engage with lifelike avatars, all of which contribute to a sense of presence and realism. This experiential learning approach enables learners to gain practical knowledge and skills in a risk-free and supportive environment, thereby enhancing their confidence and competence [22].

Collective learning and learning communities are emphasized in this metaverse-based learning environment [29]. It enables collaboration and communication between teachers and students, promoting free and equal knowledge sharing and co-creation in cyberspace. Learners benefit from interactive and multimedia resources, immersive experiences, and effective instructional design, making the metaverse an enticing platform for education. Various researchers, including Mafi [28] and Ji et al. [25], have emphasized the significance of creating interactive and multimedia learning resources, as well as collaborative and interactive learning experiences. Guo and Gao found that teachers can create collaborative learning opportunities using the metaverse, allowing students to work together in virtual teams to solve problems or complete projects [18]. Li and Yu highlighted the importance of improving the functionality of the metaverse to enhance learners' perceptions of being in the "real world" and belonging to a learning community [22].

Contextualized and situated learning are also supported by the metaverse, allowing students to investigate and reason independently [22, 25, 34]. This dynamic approach fosters a deeper understanding of complex concepts and real-life applications. Personalized learning is another effective strategy in the metaverse [24, 34]. Learners can tailor their learning experiences to suit individual needs and interests, and student-centered activities enhance overall engagement and motivation. Lee discovered that students actively engage in metaverse activities, collaboratively crafting an emergent narrative through interactions, which ultimately generates their unique narrative to arrive at a solution [33]. Guo and Gao developed experiential situational English-teaching scenarios and observed that this approach enhanced students' interactivity, immersion, cognition, and accuracy in learning English [18].

Based on this review, the use of the metaverse can create new opportunities for collaboration and communication between teachers and students, as well as among students themselves. Learners are promised free and equal opportunities for collaborative learning, knowledge sharing, and co-creation in cyberspace. The focus on effective instructional design within a virtual environment further enhances the overall learning experience, solidifying the metaverse as an enticing platform for education.

C. RQ 3) What Types of Metaverse Platforms Have Been Utilized in EFL Learning?

Kye et al. categorized the Metaverse into four scenarios: Augmented Reality (AR), Lifelogging, Virtual Worlds (VW), and Mirror Worlds [36]. This research investigates different Metaverse platforms, including Virtual Reality (VR), VW, AR, and Holography. Each of these types of the Metaverse offers diverse environments for teaching and learning. The various kinds of Metaverse integration into EFL learning and teaching offer significant advantages as a comprehensive and effective approach to enhancing language learning outcomes [20].

VR plays a crucial role in the Metaverse for English learning and offers proven advantages. Li and Yu emphasized that VR provides learners with self-directed learning experiences, allowing them to practice their English language skills in simulated real-life situations within a safe and controlled environment [22]. This immersive approach enhances students' language proficiency and communication

abilities. Wang, Tang, and Wang further supported this notion, stating that the use of VR, AI, digital twins, and other technologies creates an interpretation experience with a high level of immersion and authenticity [34]. This enables students to react quickly and effectively in real-world scenarios, making language learning more practical and applicable.

Additionally, the use of blockchain technology in VR-based English learning platforms helps preserve and analyze student data, allowing for personalized and targeted instruction to improve individual language proficiency [34]. Wu and Hung's study showed that VR significantly improved students' grammar and vocabulary usage in speaking but did not affect pronunciation, fluency, intonation, willingness to communicate, or learning autonomy [9]. Furthermore, Yuan et al. demonstrated that VR can enhance students' English learning abilities compared to voice-video-based oral communication [31]. Hwang et al. discovered that the use of an independent VR environment could alleviate students' speaking anxiety [19]. VR tools were identified as effective resources for practicing speaking skills before formal real-life situations. Hwang et al. provided insights into using VR technology for English education in a Chinese Open University, suggesting that VR's "3I" features can improve upon traditional English classes in such settings [19].

Virtual Worlds (VW) also play a crucial role in the Metaverse for English learning, as evidenced by various studies. Lee and Hwang highlighted that VW can increase learning engagement through gestures and avatar movement, enhancing 3D spatial design and visualization experiences [24]. By creating a more interactive and immersive learning environment, students can better understand complex concepts and theories. The language learning platform Immerse focuses on creating a sense of community among learners with shared interests and learning needs, thus offering contextualized language practice. Christoforou emphasized that VW contribute to the development of soft skills, such as cultural awareness, which are essential for future workplace settings [37]. Fokides's research showcased the benefits of a virtual environment [35]; they used OpenSimulator to create a multi-user virtual environment where students' avatars explored a virtual island to learn about geographical terms and concepts in English. Hwang, Shin, and Lee found that in sentiment analysis, 60.00% of Ifland users were positive, while Frame VR had 53.66% positivity, and Gather Town had 51.22% [19]. The social and educational character of VW fosters collaboration and cooperation among learners, thereby enhancing their overall language learning experience.

Gamified learning, widely applied in the Metaverse, offers significant advantages for English learning. According to Çelik and Yangın Ersanlı, incorporating gamification into language learning has been found to be effective in enhancing language learning outcomes and capturing students' attention in the classroom [30]. The use of game-like elements such as rewards, challenges, and competition encourages active participation. It fosters a positive learning atmosphere, similar to a virtual wonderland, thereby providing an engaging and effective way to teach English speaking [32]. This approach keeps students motivated, invested in the learning process, and enhances their language acquisition. Additionally, gamified learning in the metaverse provides a dynamic and interactive learning environment that promotes continuous progress and improvement.

The integration of various forms of the metaverse—such as VR, virtual worlds, and gamified learning—into English learning and teaching offers numerous advantages. These innovative approaches create immersive, interactive, and engaging learning experiences. They also promote language learning outcomes and cater to the diverse needs of English language learners. Embracing the potential of the metaverse in education opens new horizons for English language teaching and learning, revolutionizing how students acquire language skills and knowledge.

D. RQ 4) What Challenges Arise When Employing Metaverse-Based Platforms in EFL Education?

Teaching English through Metaverse-based platforms presents several challenges, which encompass three main aspects: technical readiness, network access, and privacy concerns. Technical difficulties, limited curriculum content, and language barriers hinder both teachers and students from effectively using the platform [22, 34, 38]. To address these challenges, teachers undergo training and access resources, which enables them to navigate the metaverse confidently for language instruction. Ensuring equitable access to technology is also crucial, as some students face limitations in using mobile devices or have a lack of interest in mobile technology [30].

The immersive nature of the Metaverse blurs the lines between the virtual and real worlds, potentially leading to virtual world addictions and thoughts of escapism among students [34]. Teachers strive to strike a balance between leveraging the platform's benefits and safeguarding students' well-being in both virtual and real-life settings. Additionally, concerns about safety and privacy have arisen, necessitating strict measures to protect students' personal information and ensure a secure learning environment [22]. Furthermore, integrating metaverse-based teaching with traditional classroom instruction presents challenges for educators [34]. Camilleri highlighted the possible risks associated with the prolonged use of this captivating technology [39]. Selecting appropriate instructional materials, designing a coherent educational system, and effectively combining online Metaverse learning with face-to-face teaching requires careful planning and support.

Ensuring that both teachers and students possess the necessary technical skills, addressing network accessibility issues, and safeguarding privacy concerns are vital for the successful integration of Metaverse-based platforms into language learning. Teachers must receive adequate training and support, and students need equitable access to technology and a secure virtual learning environment. By addressing these challenges, educators can harness the potential of the Metaverse to enhance language instruction and create immersive and engaging educational experiences for learners.

IV. Discussion

The article provides a comprehensive and systematic literature review on using Metaverse platforms for teaching

EFL. Metaverse-based education presents a promising and sustainable solution for both today's and future educational landscapes. This study explores the integration of Metaverse-based learning environments with existing curricula, effective pedagogical strategies, and the application of various types of metaverse in EFL learning and teaching.

Research papers related to the Metaverse and EFL mainly focus on the period between 2021 and 2023. The geographical distribution of these analyzed studies is largely concentrated in South Korea and China, featuring various Metaverse platforms to differing extents. Although several challenges in using these platforms have been identified, the article suggests their positive effects on learning engagement and outcomes, highlighting the potential of the Metaverse in English learning. This study offers valuable insights into the emerging trend of utilizing Metaverse platforms for educational purposes worldwide, and calls for further research to better understand their impact and effectiveness in improving teaching and learning outcomes. Overall, this article serves as a valuable resource for educators and researchers interested in exploring Metaverse-based platforms in EFL learning.

Based on the research findings outlined above, the integration of the Metaverse into English language education holds substantial potential for enhancing the learning experience. The use of the Metaverse has been associated with multiple positive outcomes, such as increased learner engagement, deeper, more meaningful learning experiences, and improved language learning outcomes. These benefits are attributed to the Metaverse's immersive, interactive, and engaging nature, which creates dynamic learning environments catering to the diverse needs and preferences of language learners.

A particularly significant area where the Metaverse can revolutionize language learning is in curriculum adaptation and the design of blended learning approaches. By supplementing traditional classroom instruction with metaverse-based environments, learners can engage in immersive virtual experiences that complement their face-to-face educational activities. This blended approach enables personalized and contextualized language practice, fostering a sense of community among learners with shared interests and learning needs.

Furthermore, the integration of the Metaverse has opened the door for innovative pedagogical strategies and instructional approaches. Educators have explored various techniques like gamification, collaborative learning, and interactive scenarios to boost learner motivation, participation, and knowledge acquisition. The use of game-like elements, rewards, and challenges in language learning has been proven effective in fostering a positive and engaging learning atmosphere, which encourages active participation and language acquisition.

However, the successful implementation of the Metaverse in language education comes with its own set of challenges, including technical readiness, network accessibility, and privacy concerns. To harness the full potential of the Metaverse, teachers need to undergo appropriate training to navigate the platform both confidently and effectively. Additionally, ensuring equitable access to technology and addressing safety and privacy concerns are essential in creating a secure and supportive virtual learning environment for all learners.

Some limitations of this study should also be acknowledged. Firstly, the studies referenced in this systematic review may be limited due to the databases and keywords employed, potentially omitting relevant research. Secondly, the findings are constrained by the authors' available resources. Thirdly, the review exclusively focuses on English academic articles related to Metaverse technology in education, possibly excluding valuable contributions from non-English scholarship. Lastly, due to the nascent stage of Metaverse technology and limited research in databases like Web of Science and Scopus, a comprehensive overview of the field remains challenging.

V. Conclusion

The Metaverse demonstrates significant potential for transforming language education by providing innovative, immersive, and engaging learning experiences. The future of research in Metaverse-based English learning holds great promise. By addressing the challenges identified and exploring proposed directions, researchers can unlock the full potential of Metaverse technologies for education, enhancing the teaching and learning experience for all stakeholders involved.

Integrating Metaverse-based teaching with traditional classroom instruction requires careful planning and support. Educators need to select appropriate instructional materials meticulously and design coherent educational systems. By effectively combining online Metaverse learning with face-to-face teaching, they can optimize the learning experience, creating a seamless and authentic learning environment for language learners.

Looking ahead, research on Metaverse-based English learning will continue to evolve in line with the growing demand for non-face-to-face learning options. However, due to the nascent stage of Metaverse technology, current research may not yet provide a comprehensive understanding of the subject. Nonetheless, the unique two-way interaction facilitated by Metaverse technologies sets a strong foundation for sustainable English learning. Future studies might consider incorporating practical features such as self-efficacy, satisfaction levels, and technology anxiety to deepen the understanding of the learning experience.

One promising direction for future research is the development of new EFL curricula based on Metaverse technologies. Existing research suggests that these technologies can enhance language learning and outcomes, but challenges relating to digital literacy among instructors and learners still need addressing. Therefore, future studies should focus on enhancing the digital literacy of both teachers and students. Specialized training, as highlighted by Li and Yu [22] and Mafi [28], could be instrumental in helping learners navigate virtual environments effectively. Additionally, as noted by Shu and Gu, updating learning resources to take advantage of emerging technologies in the Edu-Metaverse can lead to the creation of intelligent, immersive, and interactive multimodal learning resources

[29].

Understanding teachers' perceptions and effectiveness in using the Metaverse for education is crucial. Guo and Gao emphasize the importance of analyzing students' emotions to enable teachers to personalize their teaching methods [18], thereby creating a more effective and engaging learning experience. On a related note, cost considerations concerning VR and AR devices and software, as raised by Guo and Gao [18], must also be addressed to ensure accessibility. Privacy and security concerns about learner data in the virtual environment also warrant due attention. Empirical studies that analyze the effect of the Metaverse on English learning within the context of specific curricula could offer valuable insights.

Addressing the challenges associated with the implementation of the Metaverse is essential to fully harness its potential. With adequate training, equitable access to technology, and thoughtful instructional design, educators can open up new horizons in language learning and offer dynamic and effective educational experiences within the metaverse. The continuous exploration and integration of Metaverse technology will undoubtedly shape the future of language education. Policymakers and administrators can play a pivotal role by aligning with this educational trend and providing financial and technological support for Metaverse-based education [22]. Moreover, developers of Metaverse platforms may need to enhance the compatibility between different hardware and software to alleviate stress and anxiety for both instructors and learners.

Availability of Data and Material

The labelled data set supporting the findings of this study is available from the corresponding author upon request.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Y.J. conducted data collection, analysis, and manuscript writing. D.D. provided valuable supervision throughout the process and revised the manuscript. R.B.A.R. designed the research and provided expert insights. All authors have approved the final version.

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