LLT Journal, e-ISSN 2579-9533, p-ISSN 1410-7201, Vol. 29, No. 2, October 2026, pp. 502-522

LLT Journal: A Journal on Language and Language Teaching
http://ejournal.usd.ac.id/index.php/LLT
Sanata Dharma University, Yogyakarta, Indonesia

FROM VIRTUAL WORLDS TO ENGLISH CLASSROOMS: A BIBLIOMETRIC ANALYSIS OF METAVERSE RESEARCH IN ENGLISH LANGUAGE LEARNING

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https://doi.org/10.24071/llt.v29i2.586
received 20 February 2026; accepted 26 July 2026

Abstract

This study presents a bibliometric analysis of global research on the use of the Metaverse in English language learning. Despite increasing interest in immersive technologies such as virtual reality and augmented reality, research in this area remains fragmented across disciplines. This study aims to map the intellectual structure, research trends, and thematic development of the field. Data were retrieved from the Dimensions database, covering publications from 2021 to 2025 using a defined search strategy. A total of 164 documents were analysed using VOSviewer, employing performance analysis, bibliographic coupling, and keyword co-occurrence techniques. The findings indicate that research is concentrated in Asia, particularly China and South Korea, with emerging contributions from other regions. Four major thematic clusters were identified: applied learning contexts, pedagogical innovation in English language teaching, interdisciplinary extensions, and teacher training with AI integration. However, the results also reveal that many studies remain technology-driven, with limited direct focus on English language pedagogy. This study contributes by providing a structured overview of the field and highlighting the need for more pedagogically grounded, empirically validated research on English language learning in Metaverse environments.

Keywords: digital pedagogy, English language learning, immersive learning, metaverse, student engagement

Introduction

Immersion technology and language training have been used to create new methods of language learning in recent years. According to Zheng and Bian (2024),

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the Metaverse is a vast, networked virtual environment that blends mixed reality (MR), virtual reality (VR), and augmented reality (AR). It is one of the most cutting-edge resources for learning English (Xiaodi et al., 2024). According to Hatmanto et al. (2023), the Metaverse is a persistent, shared, and immersive digital world that exposes students to more contextual and authentic language use through gamified activities, cultural simulations, real-time communication, and avatar-based interactions. Researchers ought to pay special attention to how the Metaverse affects novel approaches to language learning as education moves more and more towards hybrid and fully virtual modalities (Jiao et al., 2024).

In the context of language education, English as a Second Language (ESL) refers to learning English in environments where English is the primary language of communication, whereas English as a Foreign Language (EFL) refers to learning English in contexts where it is not commonly used in daily life. According to Wang et al. (2022), the Metaverse provides ESL and EFL students with immersive environments that mimic real-world situations. This allows them to practise speaking, listening, reading, and writing in ways that are difficult to imitate in traditional classroom settings (Yue, 2023). Though the field is still young and dispersed, interest in integrating the Metaverse with English language development is growing. Its educational efficacy, implementation difficulties, and long-term results are all disputed because early research has mostly concentrated on technical affordances or discrete pilot projects (Bae et al., 2022; Wei, 2023).

Furthermore, the literature that is currently available is typically dispersed across fields like media studies, computer science, and education, making it challenging for researchers and educators to develop a coherent understanding of how the Metaverse is being used for English language development (Girginova, 2025). Despite the growing body of research on the Metaverse, the absence of a structured synthesis of this literature presents a critical challenge. Without a clear understanding of how research is distributed, conceptualised, and interconnected, it is difficult for educators and researchers to identify meaningful patterns, gaps, and directions for future work. This deficiency in synthesis impedes efforts to evaluate the compatibility of metaverse-based learning environments with widely accepted theories of language acquisition, such as the Communicative Language Teaching (CLT) approach, Task-Based Language Teaching (TBLT), or the Sociocultural Theory of Language Learning (Haque et al., 2024).

There are two issues with this currently. First, despite the rise in conceptual and theoretical discussion about the Metaverse's educational potential, there is still a lack of empirical research specifically examining its possible applications to English language acquisition (Jiao et al., 2024; Xiaodi et al., 2024). Furthermore, no comprehensive evaluation of the worldwide research environment in this field currently identifies important topics, important authors, collaborative networks, and emerging trends (Vitón-Castillo et al., 2022). Thus, identifying "top authors" and highly cited works requires critical reflection. Metrics such as citation counts may reflect visibility rather than quality, and may privilege certain regions, institutions, or publication practices. By examining these patterns, this study not only maps influence but also highlights potential imbalances and underrepresentation within the field. Making it crucial to assess if this field is driven by strong theoretical foundations or only technological advancement (Hatmanto et al., 2023).

Bibliometric studies that systematically examine topic clusters, citation patterns, research productivity, and trends are especially limited in the fields of English language development and the Metaverse (Moresi et al., 2023). To bridge this gap, bibliometric analysis – which uses quantitative methods to evaluate the makeup and development of scientific knowledge – is particularly well-suited. According to Zheng and Bian (2024), VOSviewer facilitates the analysis of the field's intellectual structure, the determination of research borders, the prominence of countries and institutions, and the monitoring of shifts in theme concentration over time. Additionally, research of this kind can show the level of multidisciplinary cooperation and provide details on how the Metaverse debate in language instruction has developed (Garg et al., 2025).

In order to address this significant gap in the literature, this bibliometric study offers a thorough, data-driven mapping of international research on the relationship between the Metaverse and English language development (Jiao et al., 2024; Xiaodi et al., 2024). The goal of this study is to uncover major research themes, noteworthy publications, collaboration patterns, and possible future paths by integrating concepts from indexed papers over the past 10 years. For academics and professionals, the findings will provide a starting point for further empirical study, policy formation, and innovative instructional techniques. This work has increased our understanding of the ways in which immersive virtual environments can revolutionise English language instruction in the twenty-first century.

Although bibliometric analysis does not establish causal relationships, this study is analytically informed by Sociocultural Theory (Vygotsky, 1978) and Self-Determination Theory (Deci & Ryan, 2000) to guide the interpretation of patterns identified in the dataset. To ensure analytical clarity, key constructs were operationalised in relation to the bibliometric findings. The notion of the Metaverse as a "mediational tool" was interpreted through studies emphasising avatar-based interaction, virtual communication, and collaborative task-based activities, while "interaction" was identified through keyword co-occurrence like "interaction", "collaboration", and "communication" and cluster-level patterns reflecting social engagement. In parallel, Self-Determination Theory informed the interpretation of learner engagement through indicators such as participation, autonomy in virtual navigation, and engagement-related keywords such as "student", "learner", and "activity", which correspond to the constructs of autonomy, relatedness, and intrinsic motivation. These constructs are not treated as causal outcomes but as interpretive lenses through which bibliometric patterns are theoretically contextualised.

The findings of this bibliometric analysis are therefore interpreted through these theoretical lenses to understand how current research aligns with established perspectives in English language learning. To address this gap, this study employs bibliometric analysis to systematically map global research on the Metaverse in English language learning. Specifically, the study aims to identify publication trends and key contributors, examine the conceptual structure of the field through bibliographic coupling and co-occurrence analysis, and evaluate how English language learning is positioned within the broader Metaverse research landscape.

Method

The present study used bibliometric analysis to thoroughly assess the body of research on the incorporation of the Metaverse in enhancing English language learning. Bibliometric analysis is essential because it may provide a quantitative, evidence-based overview of a rapidly growing but scattered body of literature (Lalwani, 2024). Despite the high level of scholarly interest in the Metaverse, the majority of the research is dispersed across disciplines such as computer science, linguistics, and education, making it challenging to discern general patterns and thematic orientations (Lim et al., 2024). According to Yaseen et al. (2025), this study uses bibliometric analysis to identify important authors, journals, institutions, and countries as well as to uncover theme trends, intellectual structures, and research gaps. Through this macro-level mapping, scholars, educators, and policymakers can have a better understanding of how the field is evolving and where future research could have the greatest impact.

A key analytical technique used in the paper to achieve this is bibliographic coupling. When two works quote one or more common references, this is known as bibliographic coupling, and it indicates a conceptual connection between them. In contrast to co-citation analysis, which documents prior scholarly influence, bibliographic coupling provides a forward-looking perspective by focussing on shared references in recent publications (Rejeb et al., 2023). This makes it especially useful in a new field, such as Metaverse-driven English language learning, where research is ongoing and future directions are being defined. This study identifies research clusters that share conceptual underpinnings in order to demonstrate how the academic discourse converges into specific research streams through the use of bibliographic coupling.

Examining the relationship and frequency of keywords in the selected dataset is another purpose for co-occurrence analysis. This method looks at the co-occurrence of terms, which also reveals the conceptual structure of the field and reveals emerging themes, popular issues, and understudied areas (Cassandra et al., 2023). As an example, keywords such as “Metaverse,” “virtual reality,” “language acquisition,” and “English as a Foreign Language” may often occur together, indicating main areas of research, while less related phrases may represent new or understudied issues (Ediş et al., 2023). The development of the field’s themes and the identification of conceptual links between disciplines are two areas in which this approach excels.

A reliable source of peer-reviewed articles with consistent bibliographic information is the Dimensions database, from which the dataset for this investigation was extracted. Dimensions was selected due to its wide coverage of interdisciplinary publications, making it particularly suitable for emerging research areas such as the Metaverse. Keywords, citations, and authors were among the metadata that was recovered. Data cleaning procedures were conducted to remove duplicate records, standardisation of author names, and harmonisation of keywords. A popular tool for creating and evaluating bibliometric maps, VOSviewer, was used to display and map bibliometric networks (Wider et al., 2024). According to Ismail et al. (2023), VOSviewer provides a comprehensive understanding of how the Metaverse is impacting English language learning research globally by identifying conceptual structures and intellectual clusters set at a minimum keyword occurrence threshold of 5.

In addition to bibliometric mapping, a structured data-charting approach was employed to enhance analytical transparency. A data extraction form was developed to record key attributes of each document, including publication year, authors, country, research focus, and thematic orientation. To support interpretive analysis, a coding framework was developed based on recurring concepts identified in the dataset, particularly those related to interaction, engagement, and pedagogical application (Zou et al., 2025). Coding was conducted at the abstract and keyword level to identify thematic consistency across studies. This process aimed to categorise patterns for interpretation rather than evaluate study outcomes.

Data collection and database selection

The search method for this bibliometric analysis was carefully designed to locate relevant and high-quality material on the impact of the Metaverse on the development of the English language. The first pool of 197 articles from the Dimensions database spanned the years 2021-2025 extracted on 16th September 2025 as in Table 1. The keywords "metaverse" and "English" were used to ensure the search was limited to studies that directly linked immersive virtual technology to English learning. The search string ("metaverse" and "English") was intentionally designed to prioritise precision over breadth. While broader search terms such as "EFL", "ESL", or "virtual environments" could potentially increase the dataset size, they may also introduce studies that are only indirectly related to English language learning in Metaverse contexts.

Given the exploratory nature of this study, a focused search strategy was adopted to ensure retrieved publications explicitly address the intersection of the Metaverse and English-related learning contexts. This approach enhances the conceptual relevance and internal consistency of the dataset, which is critical for meaningful bibliometric mapping. To enhance the quality of the dataset, only papers and proceedings were included; book chapters, editorials, and reports were excluded. This restricting process produced the final dataset of 164 studies, which formed the basis for bibliometric analysis. The systematic approach ensures that the data represents research-oriented and peer-reviewed contributions, providing both depth and reliability when mapping academic trends.

The screening process was conducted in two stages. First, records were filtered based on document type and relevance to the search criteria. Second, titles and abstracts were reviewed to ensure alignment with the focus on English language learning in Metaverse contexts. The screening was conducted by two authors, and disagreements between the authors were resolved through discussion until consensus was reached. Detailed numerical outcomes of the screening process are presented in the PRISMA flowchart (Figure 1), ensuring transparency and reproducibility of the dataset selection.

Table 1. Inclusion criteria for bibliometric analysis

Dimension Database	ALL
Time period	2021 to 2025
Search keywords	"metaverse" or "English"
Document Type	Article or Proceedings

The PRISMA flowchart (Figure 1) provides a visual representation of the screening and selection process. None of the 197 records that were initially discovered were excluded due to the years of publication because all of them came inside the desired era (2021-2025). However, 33 records were rejected because they did not meet the qualifications to be accepted as articles or proceedings. Consequently, the final sample consisted of 164 appropriate studies that were included for analysis. Although PRISMA is commonly used in systematic literature reviews, it is adopted here to ensure transparency and reproducibility in the data selection process rather than for qualitative synthesis. The flowchart ensures reproducibility and adherence to systematic review requirements by providing a clear explanation of the dataset's filtering procedure. It exhibits a rigorous process that enhances the validity of the findings by ensuring that only relevant, peer-reviewed resources were retained.

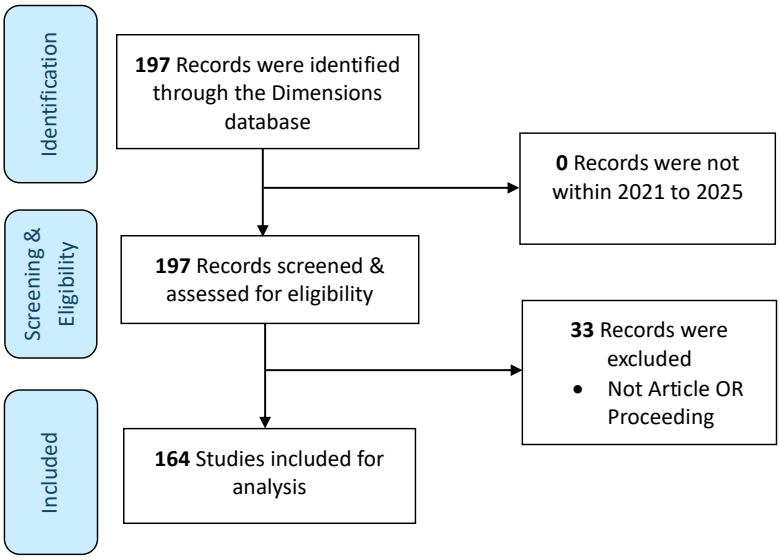


Figure 1. PRISMA flow chart

The trend analysis reveals the impact of citations and the growth of publications throughout the 2021-2025 period. A total of 164 papers were extracted, each containing an average of 9.62 citations. This points to a steady stream of studies and the growing scholarly influence of the Metaverse on learning English. Growing scholarly interest in the topic is indicated by the increased trend in publication numbers, especially as the post-pandemic digital revolution in education accelerates. On the other hand, the citation pattern shows that studies in this field are becoming more widely recognised and acknowledged, indicating the Metaverse's increasing impact on innovative teaching methods and future research directions.

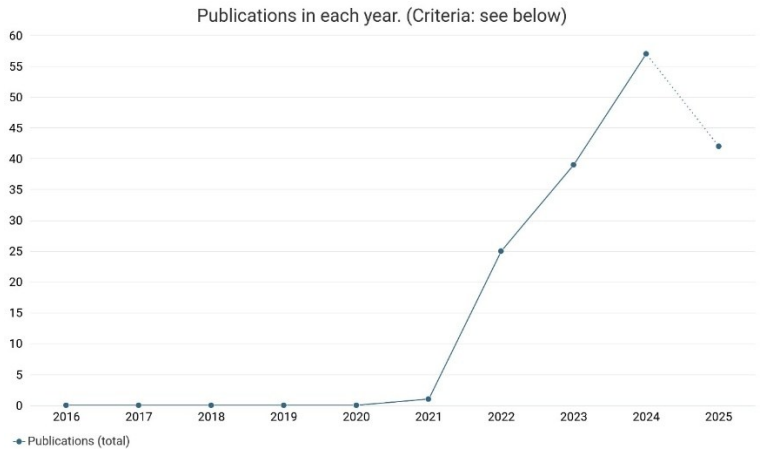


Figure 2. Quantity of publications and citations between 2021 and 2025

Findings and Discussion

Findings

Performance analysis

Performance analysis, a key component of bibliometric research, is intended to assess the influence and productivity of academic contributions in a particular field of study. By giving a quantitative summary of the most important papers, writers, journals, institutions, and nations, it shows where study is focused and whose works or figures have the biggest impact. Performance analysis records the growing amount of research as well as its academic prominence through citation impact, making it especially significant for the Metaverse issue in English language development. In doing so, it offers valuable perspectives on the state of research, recognises prominent contributors, and accentuates capabilities for collaboration among institutions and countries.

Highest-cited documents

The most often cited publications exhibit both diversity and subject alignment. Technology-Enhanced Education through VR-Making and Metaverse-Linking to Foster Teacher Readiness and Sustainable Learning by Lee and Hwang (2022), the most significant study with 256 citations, revealed the promise of the Metaverse for sustainable learning. Similarly, 218 citations were found for Siyaev and Jo's 2021 study on the Aircraft Maintenance Metaverse, suggesting that the Metaverse extends into applied training scenarios and demonstrates interdisciplinary overlaps. The architecture of English training in the Metaverse was the focus of a notable study by Guo and Gao (2022), which gained 117 citations, demonstrating its high degree of application to language courses. This implies that language-oriented research is beginning to gain traction in the broader discourse, even if technical and healthcare applications account for the majority of top citations.

Influential journals

The distribution of publications among journals shows both breadth and specialisation. With five articles and forty-two citations, Education and Information Technologies is the most significant source for research on technology-enhanced learning. Frontiers in Psychology is a publication that highlights the multidisciplinary significance of psychological perspectives in evaluating

immersive learning, as seen by the 173 citations in three pieces. Regional journals such as the Korean Society of Culture and Convergence and the Korean Association for Learner-centred Curriculum and Instruction each submitted five papers, indicating active engagement but limited global reach, albeit with a somewhat smaller citation effect. Even while internationally indexed journals are the most visible in terms of citation visibility, local and regional journals are significantly contributing to the spread of information.

Top authors

The authors' performance reflects up-and-coming leaders in the field. Yohan Hwang has established himself as a major figure in educational research related to the Metaverse with 7 articles and 281 citations, making him the most prolific and influential contributor. Although they have produced fewer works than Hwang, authors such as Çelik and Ferdi have had a substantial impact, as evidenced by their three publications and seventy citations. In spite of their many publications, a number of authors – including Piayura, Boonmas, and Mahamid - have gotten little to no citations, indicating that their works may be more recent contributions that have not yet achieved notoriety. With a small number of scientists generating much of the field's intellectual thrust, this disparity highlights how research findings are not uniformly recognised.

Leading institutions

Institutional analysis demonstrates the significant contributions made by both Asian and Western universities. The three papers that garnered 266 citations, indicating the contributions' global recognition, showed Jeonju University's significant significance. With four papers and seventy citations, Ondokuz Mayıs University also showed steady productivity and recognition. Even though they only had four papers and 15 citations, Jeonbuk National University also made a contribution, indicating that their global presence is growing but still very limited. The involvement of internationally recognised universities is demonstrated by establishments like as Indiana University Bloomington and Hong Kong Polytechnic University, which connect the study beyond geographic borders. These patterns demonstrate that, despite Asian universities being the most productive, global collaboration is supporting the research environment.

Geographical distribution

In terms of volume and influence at the national level, China and South Korea lead the way. While South Korea provided 15 papers with 597 citations, China showed its dominance in shaping the discourse by offering 15 papers with 500 citations. This shows that government and institutional investments in immersive learning technology have been substantial in these areas. Indicating a geographically diverse research environment, other countries such as the US (5 documents, 94 citations) and Turkey (8 documents, 87 citations) also make substantial contributions. The topic is becoming more and more popular, as seen by the little contributions from Malaysia (3 papers, 2 citations) and Pakistan (3 documents, 5 citations). Overall, research output from throughout the world highlights Asia's leadership and shows a rise in international participation.

Bibliographic coupling analysis

The results of the bibliographic coupling reveal some highly referenced works that are foundational works in the disciplines of the Metaverse and English language learning. With 256 citations, Lee and Hwang's (2022) most cited work, Technology-Enhanced Education via VR-Making and Metaverse-Linking to Foster Teacher Readiness and Sustainable Learning, highlighted the importance of this study in bridging the gap between immersive technology and sustainable pedagogy. Siyaev and Jo (2021) showed that even though they focused on aeroplane maintenance training in the Metaverse, their 218 citations showed that the technical applications of immersive technology might affect educational frameworks.

Table 2. Top cited documents (bibliographic coupling context)

Rank	Authors	Title	Citations	Total Link Strength
1	Lee & Hwang (2022)	Technology-Enhanced Education through VR-Making and Metaverse-Linking to Foster Teacher Readiness and Sustainable Learning	256	7
2	Siyaev & Jo (2021)	Towards Aircraft Maintenance Metaverse Using Speech Interactions with Virtual Objects in Mixed Reality	218	0
3	Petrigna & Musumeci (2022)	The Metaverse: A New Challenge for the Healthcare System: A Scoping Review	189	18
4	Guo & Gao (2022)	Metaverse-Powered Experiential Situational English-Teaching Design: An Emotion-Based Analysis Method	117	5
5	Shu & Gu (2023)	An Empirical Study of A Smart Education Model Enabled by the Edu-Metaverse to Enhance Better Learning Outcomes for Students	113	17
6	Cheng et al. (2022)	Exploring the metaverse in the digital economy: an overview and research framework	62	40
7	Li & Yu (2023)	A systematic review on the metaverse-based blended English learning	56	44
8	Çelik & Yangın Ersanlı (2022)	The use of augmented reality in a gamified CLIL lesson and students' achievements and attitudes: a quasi-experimental study	49	3
9	Batnasan et al. (2022)	ArSL21L: Arabic Sign Language Letter Dataset Benchmarking and an Educational Avatar for Metaverse Applications	35	0
10	Yuan et al. (2023)	Educational metaverse: an exploration and practice of VR wisdom teaching model in Chinese Open University English course	31	7

Other works with an education focus that demonstrate the increasing recognition of the Metaverse in language learning situations include Guo and Gao

(2022) on immersive English-teaching design (117 citations) and Shu and Gu (2023) on smart education models (113 citations). This link was further strengthened by Li and Yu (2023), who in their systematic review of blended English learning in the Metaverse (56 citations) gave a comprehensive overview of educational methods. Additionally, although it has gotten less citations, Yuan et al.'s (2023) investigation of VR-based English courses in Chinese colleges is significant for contextualising large-scale deployments (31).

Collectively, these papers show that the use of the Metaverse in English language learning indicates increasing research attention. Although the field remains at an early developmental stage, particularly through reviews and design-based empirical works, even though citation counts are dominated by interdisciplinary contributions in technical training and healthcare.

Bibliographic coupling by clusters

Cluster 1 focusses on real-world Metaverse applications in fields such as medical English, language learning, and human development in general. A thorough analysis of metaverse-based blended English learning is provided by Li and Yu (2023), while Petrigna and Musumeci (2022) focus on healthcare applications. Other research examines vocabulary retention, student interaction, and how students view medical English in immersive settings. Collectively, these contributions demonstrate the Metaverse's multi-domain learning potential and benefits above traditional language training. According to Gonzalez-Moreno et al. (2023) and Perez et al. (2023), the inclusion of well-being and humanisation themes broadens its applicability to psychological and social development. This cluster is a prime example of the interdisciplinary character of Metaverse research, which looks at English language training, technology-enhanced human interaction, and health sciences. In a range of educational contexts, it represents the useful and applied component of Metaverse-driven pedagogy. From a sociocultural perspective, the patterns observed in this cluster suggest that the Metaverse serves as a mediational space in which language learning is shaped through interaction and social participation. The emphasis on collaborative tasks and immersive communication reflects the role of social engagement in facilitating meaning-making and language development.

In Cluster 2, formal English teaching and learning approaches are improved through the usage of Metaverse apps. Lee and Hwang (2022) explore VR-making and metaverse-linking to enhance teacher readiness, while Shu and Gu (2023) introduce the Edu-Metaverse as a model for enhancing learning results. Empirical techniques like as case studies and quasi-experiments are commonly employed in this category of study to investigate the effectiveness of gamified and immersive environments. Çelik and Yangın Ersanlı (2022) demonstrate the benefits of augmented reality in a CLIL class, while Yuan et al. (2023) outline VR teaching methods in a Chinese Open University English course. These works suggest that Metaverse-based environments are associated with increased learner participation, engagement, and opportunities for language use. This cluster highlights the pedagogical heart of the field, rethinking language classrooms as technology enhanced, interactive environments that transform student outcomes and instructor practices in English language training. Interpreted through Self-Determination Theory, the prominence of learner participation and engagement in this cluster

highlights the potential of Metaverse environments to support intrinsic motivation. Elements such as autonomy in navigation, interactive activities, and immersive experiences may contribute to learners' sense of competence, relatedness, and sustained engagement in English language learning.

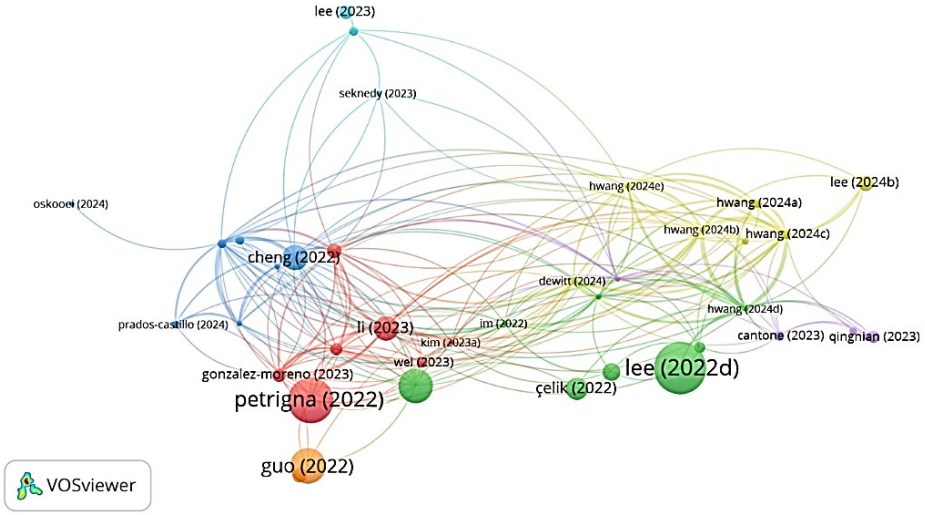


Figure 3. Bibliographic coupling by clusters (VOSviewer Visualisation)

Cluster 3 represents an interdisciplinary extension of Metaverse research into the domains of multilingual communication, marketing, law, economics, and security. An overview of the Metaverse in the digital economy is provided by Cheng et al. (2022), laying the foundation for further research on the Metaverse's broader societal implications. Yadav et al. (2024) and Kumar et al. (2025) investigate marketing in the Metaverse; however, Prados Castillo et al. (2024) expand this scope to encompass travel and customer behaviour. Beyond corporate applications, Sanghvi et al. (2024) address online safety by developing AI-based hate speech detection for gaming in the Metaverse, while Karapatakis (2025) explores the legal implications under English law. Finally, Oskooei et al. (2024) introduce a direct connection between language accessibility and the Metaverse by demonstrating real-time multilingual lip-sync translation. These studies' combined results show that the Metaverse is not just for education, but rather offers a cross-sectoral platform where language interacts with technology in the areas of communication, economics, law, and security. These findings can be understood through both sociocultural and motivational perspectives. The Metaverse appears to serve as a mediating tool that enables interaction and collaborative learning while simultaneously fostering learner engagement through immersive, participatory experiences. This dual role suggests that technological environments not only facilitate communication but also shape motivational dynamics in language-learning contexts.

The final cluster, Cluster 4, focusses on incorporating the Metaverse into AI-enhanced pedagogy and teacher training. Most of the research in this category focus on pre-service English teachers, examining the effects of immersion environments on their confidence, creativity, and readiness for the field. While Hwang and Lee (2024a) investigate avatar-supported speaking practice, Lee et al. (2024) use AI

chatbots in 3D Metaverse environments to increase awareness of global Englishes. While Lee and Kim (2024) investigate learning by design through the development of virtual spaces, Jiao et al. (2024) provide a thorough review of Metaverse platforms for EFL training. Collectively, these works indicate the potential role of the Metaverse in supporting teacher development and professional readiness. This cluster has a dual emphasis on language pedagogy and teacher identity building, presenting the Metaverse as a learning environment for students and a training ground for teachers. While this cluster shows strong potential for interaction and engagement, the limited explicit integration of pedagogical frameworks suggests a gap between technological affordances and theory-driven language-learning practices. From both sociocultural and motivational perspectives, this highlights the need for future studies to more deliberately align immersive environments with established principles of interaction and learner engagement.

Table 3. Bibliographic coupling by clusters

Cluster No and Colour	Cluster Labels	No. of Articles	Representative Publications
Cluster 1 (Red)	Applied Metaverse in Learning and Well-being	8	Petrigna & Musumeci (2022); Li & Yu (2023); Çelik & Baturay (2024); İbili et al. (2024); Gonzalez-Moreno et al. (2023); Wei (2023); Kim (2023); Perez et al. (2023)
Cluster 2 (Green)	Pedagogical Innovation in English Language Teaching	8	Lee & Hwang (2022); Shu & Gu (2023); Çelik & Yangın Ersanlı (2022); Yuan et al. (2023); Chen (2023); Hwang (2024); Lee & Ko (2024); Im (2022)
Cluster 3 (Blue)	Metaverse, Digital Economy, and Multidisciplinary Interfaces	7	Cheng et al. (2022); Yadav et al. (2024); Sanghvi et al. (2024); Prados Castillo et al. (2024); Kumar et al. (2025); Karapatakis (2025); Oskooei et al. (2024)
Cluster 4 (Yellow)	Pre-service Teacher Training and AI-driven Language Pedagogy	7	Lee et al. (2024); Hwang et al. (2024); Hwang & Lee (2024a); Lee & Kim (2024); Hwang & Lee (2024b); Hwang & Lee (2024c); Jiao et al. (2024)

Co-occurrence analysis of keywords

The most often used keyword, "student," appears 64 times, demonstrating the significance of learners in studies on English instruction pertaining to the Metaverse. The words "application" (44) and "paper" (44) come in second and third, respectively, suggesting that a significant amount of the conversation is about practical applications and scholarly assessments. The word "learner" (36) highlights the field's learner-centred emphasis, while "challenge" (36) describes enduring barriers, such as pedagogical integration or technology limitations. The word "world" (34) is commonly used to describe virtual or immersive worlds, which are crucial for developing settings for experiential learning.

Table 4. The 15 most frequent keywords in the co-occurrence analysis

Rank	Keyword	Occurrences	Total Link Strength
1	student	64	0.6165
2	application	44	0.5589
3	paper	44	0.3119
4	challenge	36	0.8492
5	learner	36	0.9508
6	world	34	0.7286
7	article	33	2.6167
8	interaction	31	0.5679
9	opportunity	30	0.367
10	teaching	30	0.4387
11	teacher	29	0.9065
12	literature	27	2.8531
13	activity	26	0.258
14	metaverse platform	26	0.8968
15	participant	26	1.1528

The use of the terms “literature” (27) and “article” (33) highlights the value of systematic reviews and bibliometrics in bringing different studies together. While “teacher” (29) highlights the importance of educators’ roles, “interaction” (31), “opportunity,” and “teaching” (30) underline the educational affordances of the Metaverse. Finally, the terms “metaverse platform” (26), “activity” (26), and “participant” (26) illustrate the interactive and practical nature of research in this area, where studies often focus on real-world classroom experiments and platform-based implementations.

Co-occurrence analysis by clusters

Cluster 1 reflects the philosophical and intellectual underpinnings of metaverse research in English language development. The terms “paper,” “application,” “challenge,” “literature,” “article,” and “world” denote a strong emphasis on academic debates, reviews, and theoretical underpinnings. The fundamental objective here is to map the Metaverse’s promise and limitations as a new discipline and to emphasise its broader cross-domain implications. This cluster commonly exhibits artificial intelligence, suggesting that intelligent technology and immersive platforms are having an increasing impact on instructional strategies. Collectively, these clusters draw attention to the effort to integrate various studies into a coherent body of knowledge while also highlighting barriers to broad acceptance. Scholars are framing the Metaverse as an educational innovation and an interdisciplinary phenomenon. This is the intellectual framework of the field.

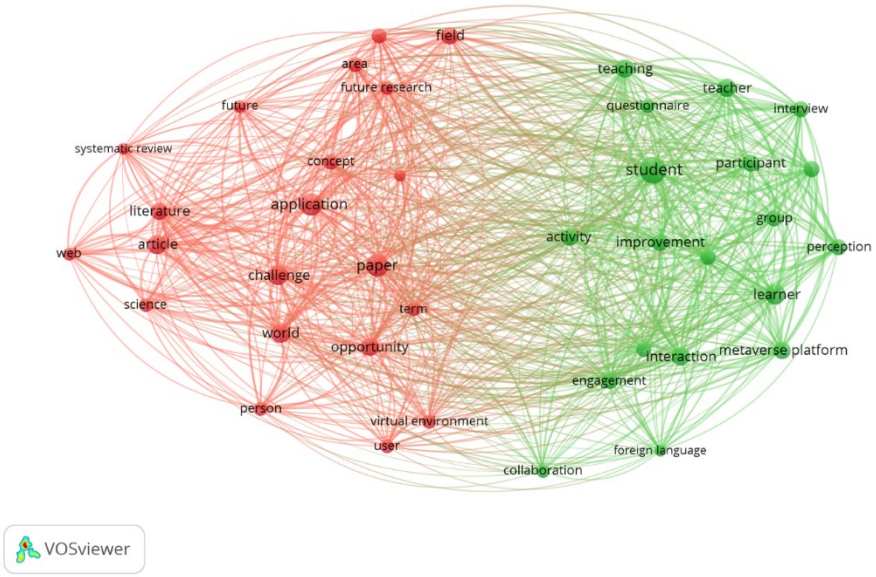


Figure 4. Co-occurrence analysis (VOSviewer Visualisation)

Cluster 2 captures the applied side of Metaverse research by emphasising the classroom and student experience. Among the key terms are student, teaching, teacher, activity, interaction, collaboration, learner, participant, and metaverse platform. These words encapsulate the transformative shift towards learner-centred education as well as the crucial role that instructors and students play in immersive learning environments. This cluster reflects how the Metaverse is being explored as a platform for engaging activities, interaction, and collaborative learning experiences. The emphasis on interaction and engagement suggests that the primary focus of study is on enhancing motivation, involvement, and communication abilities. It also demonstrates how educators are increasingly experimenting with metaverse platforms to rethink traditional approaches and allow for more immersive and participatory ways. This cluster represents the practical classroom-oriented heart of the discipline, where the potential of the Metaverse to revolutionise English learning and instruction is evaluated.

Table 5. Co-occurrence analysis of keywords in metaverse research for English language learning

Cluster No and Colour	Cluster Label	Number of Keywords	Representative Keywords
Cluster 1 (Red)	Scholarly Foundations and Conceptual Expansion	21	"paper", "application", "challenge", "literature", "article", "field", "world", "opportunity", "artificial intelligence"
Cluster 2 (Green)	Pedagogical Practice and Learner Engagement	19	"student", "teaching", "teacher", "participant", "learner", "engagement", "metaverse platform", "activity", "interaction", "collaboration"

Discussion

The findings of this study reveal that research on the Metaverse in English language learning is currently characterised by strong technological orientation and interdisciplinary expansion. The dominance of countries such as China and South Korea suggests that national investment in digital education infrastructure plays a significant role in shaping research productivity. However, the results also indicate that English language learning remains a secondary focus within the broader Metaverse research landscape. Many highly cited studies are situated in technical, healthcare, or economic domains, reflecting a field that is still evolving and not yet fully grounded in language pedagogy.

The patterns are reflected in specific studies identified in the bibliometric analysis. Lee and Hwang (2022) and Shu and Gu (2023) highlight immersive environments that emphasise interaction and learner participation, while Li and Yu (2023) demonstrate structured pedagogical applications of Metaverse-based learning. Yuan et al. (2023) further provide empirical examples of VR-supported English instruction, illustrating how immersive environments are being applied in language learning contexts. However, it is important to note that this study does not include a formal quality appraisal of the individual studies. As a bibliometric analysis, the focus is on mapping patterns and trends rather than evaluating methodological rigour or effectiveness. Therefore, interpretations related to interaction, engagement, or learning outcomes should be understood as indicative patterns rather than causal conclusions.

From a sociocultural perspective, the Metaverse may be interpreted as a mediational tool that facilitates language learning through interaction and shared meaning-making. Many studies within the dataset emphasise collaborative activities, avatar-based communication, and simulated real-world tasks, which align with the concept of learning through social interaction. At the same time, the prominence of keywords such as “student,” “interaction,” and “engagement” reflects the importance of motivational constructs. From a Self-Determination Theory perspective, the patterns suggest potential alignment with constructs of autonomy, relatedness, and competence.

From a theoretical perspective, the identified clusters partially align with sociocultural and motivational theories, particularly regarding interaction and learner engagement. However, the limited explicit integration of established language learning theories suggests a gap between technological innovation and pedagogical application. The findings indicate the need for future research to move beyond exploratory and technology-driven approaches towards theory-informed and pedagogically grounded studies. Greater emphasis on English language teaching frameworks, classroom implementation, and empirical validation is necessary to strengthen the field’s relevance to language education.

Theoretical implications

The results of the study contribute to ongoing theoretical discussions on technology-enhanced language learning by situating the Metaverse within recognised frameworks of digital pedagogy and second language acquisition. The development of clusters focused on pedagogical innovation and teacher preparation highlights how immersive learning aligns with sociocultural theory (Vygotsky, 1978), which stresses language acquisition through contextualised practice and

real-world involvement. Likewise, self-determination theories (Deci & Ryan, 2000) that emphasise the use of immersive tasks to foster learner autonomy and motivation align with the integration of AI-powered tools into the Metaverse. The interdisciplinary clusters that link education, healthcare, and the digital economy lend credence to the need for new hybrid theoretical models that integrate linguistics, psychology, and human-computer interaction, demonstrating that the Metaverse appears to extend beyond traditional language-learning boundaries (Cheng et al., 2022).

By mapping these connections, our study contributes to the conceptual scaffolding of the field and establishes the foundation for future research aimed at enhancing theoretical frameworks for immersive language learning. Bibliographic coupling was used to identify four thematic clusters: applied learning, pedagogical innovation, well-being, transdisciplinary interfaces, and pre-service teacher training. These categories show how diverse the subject is, with some studies focussing on classroom-level practices and others exploring broader links to economics, law, and healthcare. This diversity highlights the Metaverse's interdisciplinary nature and its potential to transform not only English instruction but the educational system as a whole.

Co-occurrence analysis further supported this dualism by separating two main conceptual strands: academic foundations and conceptual extension, and instructional practice with learner involvement. When considered collectively, these results demonstrate the theoretical and applied thrust of the field. More multidisciplinary collaboration and empirical backing will be required to firmly establish the Metaverse's position in language education research in the future.

Practical implications

In practical terms, this analysis provides legislators, educators, and developers with valuable insights for integrating the Metaverse into English language education. The frequency of words like learner, student, and interaction highlights how important it is to design immersive environments that encourage collaboration and teamwork. Educators may utilise metaverse platforms to create opportunities for communication practice through task-based simulations, such as cultural exchanges or role-playing activities (Guo & Gao, 2022).

Organisations and authorities may also consider financing infrastructure and training programs to ensure equitable access and successful integration, particularly in wealthy countries like South Korea and China (Lee & Hwang, 2022). According to the study, developers must combine usability and educational affordances when designing systems that support both teacher-led and self-directed learning. The findings suggest the potential value of immersive, scalable, learner-centred approaches that could transform English language teaching across a range of educational contexts.

Conclusion

Through the mapping of the evolving research environment on the Metaverse's function in English language development, this bibliometric analysis has yielded theoretical and practical insights. The performance research highlighted noteworthy works and active contributors, particularly from China and South Korea, demonstrating Asia's leadership in immersive learning innovation. Bibliographic

coupling revealed four topic clusters that illustrate the breadth and depth of research activity: applied learning and well-being, educational innovation, transdisciplinary interfaces, and teacher training. With keywords like student, interaction, and metaverse platform emphasising practice-driven applications, co-occurrence analysis, on the other hand, supported a dual emphasis on learner-centred education and conceptual progress.

In addition, this study contributes to the theoretical understanding of immersive language learning by demonstrating how bibliometric patterns reflect key constructs of sociocultural interaction and learner motivation. These insights provide a foundation for future theory-driven research in Metaverse-based English language learning. The findings of the study demonstrate how collaborative, immersive learning in the Metaverse may contribute to the development of theoretical frameworks for second language acquisition and inform teaching strategies. According to SDG 4: Quality Education, these results suggest how immersive technology may support equitable and inclusive access to engaging educational opportunities. Nevertheless, the use of a focused search string may have excluded studies that examine similar concepts under different terminologies (e.g., virtual worlds, EFL/ESL contexts). Future research may consider broader search strategies to capture a wider scope of related literature.

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