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The App-solute Call of the MALL: A Bibliometric Analysis of Mobile Assisted Language Learning Research (2011–2025)

Ecem KOPUZ[1]
Galip KARTAL[2]

Abstract

This study provides a comprehensive bibliometric analysis of Mobile-Assisted Language Learning (MALL) research published between 2011 and 2025, mapping the field's growth, intellectual structure, and evolving thematic priorities. Drawing on 415 SSCI-indexed journal articles retrieved from the Web of Science Core Collection, the analysis employs citation, co-citation, and keyword co-occurrence techniques using VOSviewer to identify influential authors, sources, and research clusters. Findings reveal four major developmental phases in MALL: early adoption focused on vocabulary and SMS-based learning; expansion during the app-driven boom; pandemic-induced consolidation; and recent innovation driven by artificial intelligence, augmented/virtual reality, and adaptive mobile systems. Co-citation networks highlight the foundational role of scholars such as Kukulska-Hulme, Burston, and Stockwell, while keyword trends demonstrate increasing attention to motivation, engagement, and AI-enhanced learning environments. Overall, the study shows that MALL has matured into a multidimensional research domain shaped by technological advances and shifting pedagogical needs, offering insights for future research directions in mobile and AI-supported language learning.

Keywords: Mobile assisted language learning, MALL, bibliometric analysis, mapping, co-citation

[1] Science Fellow Researcher, The CUNY Graduate Center, City University of New York, New York, USA
ekopuz@gradcenter.cuny.edu
[2] Assoc. Prof. Dr, Necmettin Erbakan University, Türkiye

Introduction

Technology now permeates every aspect of daily life. Karakaş and Kartal (2020) depict this landscape as a "jungle," suggesting that technology users resemble "adventurers" who must navigate through it—rather than bypassing it above or below—to sustain themselves. echnology has become an inseparable part of language instruction, offering efficiency and enhancing lesson delivery and student engagement in classrooms worldwide (Softa, 2022). Technology which found its way into language instruction with an ancillary role is spectacularly becoming more integrated and continues to be a normal part of daily practice. Owing to technology, learning a foreign language is more attainable now than ever, and the phenomenon has become a nascent field of research. Emerging technologies such as virtual and augmented reality, online platforms, and mobile apps have transformed language learning by providing accessibility, personalization, and real-world immersion (Șișianu & Pușcașu, 2024).

Mobile-Assisted Language Learning (MALL) refers to the use of mobile devices (e.g. smartphones and tablets) to facilitate language learning, capitalizing on their portability and connectivity (Karakaya & Bozkurt, 2022). Since the early 2010s, MALL has evolved from a nascent niche into a mainstream component of language education, paralleling the rapid advancement and ubiquity of mobile technologies. Research in this field expanded dramatically over the past decade and a half (Burston 2014; Hwang & Fu 2019). For instance, one early review found that the number of MALL studies grew quickly from 2008 onward, peaking around 2012 as mobile phones and tablet computers became popular tools for language learning (Duman et al., 2015; Wang et al, 2024). This growth mirrors the broader surge in MALL research. MALL has potential to improve the interactivity and mobility of the learning experience and engaging learners in situated learning, augmented reality and game-based learning (Godwin-Jones, 2017; Naismith et al. 2004; Reinders & Pegrum, 2017).

Despite numerous individual studies and a few partial reviews, the MALL domain has not yet been holistically synthesized through bibliometric means. Prior syntheses have either covered earlier years (e.g. 2000–2012), (Duman et al., 2015) or focused on specific aspects of mobile learning. A recent scientometric study of CALL identified *MALL* as one of the notable emerging sub-fields driving new research (Mohsen et al., 2024) underscoring MALL's growing significance. However, we lack a comprehensive bird's-eye view of the trends, influential works, and thematic evolution of MALL research spanning the critical 15-year window from 2011 to 2025. This period witnessed significant shifts – from the early adoption of apps, through a boom of mobile applications, to an unexpected pandemic-induced pivot to online learning, and into the current era of artificial intelligence (AI) and immersive technologies. Each phase brought new research questions and pedagogical implications, making it imperative to examine the trajectory and turning points of MALL scholarship.

Four Phases of MALL Development (2011–2025)

In analyzing 15 years of MALL literature, we conceptually partition the timeline into four major developmental periods, each characterized by distinct technological contexts and research foci. This periodization is informed by both historical milestones and prior literature observations, and it provides an organizing framework to compare how MALL research evolved over time.

2011–2014: Early MALL Adoption (Foundational Stage)

This phase represents the *early years of widespread mobile learning research* in language education. Smartphones were still emerging as ubiquitous devices, and researchers were beginning to explore their potential in language learning, often extending prior mobile experiments with cell phones and PDAs. Empirical studies during 2011–2014 were relatively few but growing in number (Duman et al., 2014). Common themes included SMS-based language practice, vocabulary learning through mobile phones, and pilot implementations of mobile apps or audio podcasts for language learners. Notably, a content analysis of studies up to 2012 found that teaching vocabulary via mobile devices remained a dominant topic in this era.

2015–2018: The App Boom (Expansion Stage)

In this period, MALL research expanded significantly in tandem with the *explosion of mobile apps* and widespread smartphone ownership across the globe. App stores (Apple's and Android's) matured, offering a plethora of language learning applications to the public. Consequently, researchers turned their attention to evaluating and leveraging these apps for language acquisition. The number of MALL publications accelerated during these years (with dozens of studies each year, as indicated by bibliometric review (Karakaya & Bozkurt, 2022). Popular apps like Duolingo, Babbel, and Memrise gained prominence and were frequently the subject of studies or at least context for discussions, epitomizing the gamified, self-paced learning trend that defined this era (Alisoy & Sadiqzade, 2024). We also see the beginnings of *adaptive learning* in this era – some studies incorporated AI-driven personalization on a small scale, such as apps that adapt difficulty based on user performance (Kartal & Yeşilyurt, 2024).

2019–2021: Pandemic-Driven Utilization (Consolidation Stage)

The years 2019 to 2021 saw an unprecedented impetus for online and mobile learning due to the COVID-19 pandemic. This period can be viewed as a stress-test and consolidation stage for MALL: what was previously optional became, in many cases, *essential* for continuity of language education. With lockdowns and the shift to remote instruction worldwide, mobile devices and apps turned into primary platforms for language teaching and learning. Research during the pandemic responded quickly, resulting in a surge of studies on mobile learning in fully online or hybrid environments (Wang et al., 2024). A recent review noted that interest in mobile applications for language teaching became *especially extensive since the advent of COVID-19* (Wang et al., 2024). Key themes in this era's literature include: the effectiveness of mobile tools for synchronous online learning (e.g. using mobile videoconferencing or chat

for real-time classes), asynchronous learning via apps or social media (students engaging in practice outside class time on their phones), and the challenges and opportunities of mobile learning at scale.

2022–2025: AI & AR/VR Integration (Emerging Innovation Stage)

The most recent period is characterized by the infusion of *advanced technologies* – notably AI, Augmented Reality (AR), and Virtual Reality (VR) – into MALL, pushing the boundaries of what MALL can do. Emerging technologies such as AR, VR, and AI are shaping the next generation of MALL tools, offering increasingly immersive and personalized learning experiences (Alisoy & Sadig, 2024). Research in 2022–2025 builds on this convergence: for example, studies have begun exploring one of the biggest shifts in this era is the introduction of conversational AI (chatbots and large language models) to MALL; for instance, the release of ChatGPT (late 2022) opened new possibilities for interactive, AI-driven language practice, and we anticipate the literature beginning to reflect pilot studies integrating such AI tutors into mobile learning. Another burgeoning theme is the combination of AR/VR with AI (sometimes termed an "AI-empowered metaverse" for language learning, though this remains at an exploratory stage. In terms of pedagogy and theory, the 2022–2025 research often frames itself around personalized learning, learner engagement, and multimodal learning experiences. There is also increased attention to ethics and data privacy with mobile AI tools, as well as ensuring inclusivity (making sure advanced tech doesn't leave some learners behind). In short, this period is pushing MALL into new frontiers: studies are not only measuring learning outcomes but also grappling with how these cutting-edge tools transform the learner's experience. As such, our bibliometric analysis will pay special attention to identifying the emergence of keywords like "artificial intelligence", "augmented reality", "VR", "chatbot", etc., and mapping how they connect with traditional MALL topics – indicating a convergence of old and new paradigms.

Research Objectives and Questions

The rationale for this study is grounded in the need to chart the intellectual landscape of MALL as it matured over four distinct developmental periods. By conducting a bibliometric analysis, we aim to reveal how MALL research topics, methods, and collaborations have evolved in response to technological innovation and educational contexts. This approach will illuminate patterns such as which topics rose to prominence, how research communities formed and interconnected, and how external events (like the COVID-19 pandemic or the advent of AI-driven tools) influenced the direction of MALL research. Understanding these patterns is not only of scholarly interest but also practically relevant – it can help researchers identify past gaps to address and help educators discern which aspects of mobile learning have proven most (or least) effective over time. In pursuit of this goal, the research is guided by the following specific questions:

1. How has the volume of MALL research output grown from 2011 to 2025, and what are the major publication venues and prolific contributors?

2. Which reference, authors, and journals have been most influential in the MALL field, and how are they interlinked?
3. What are the major research themes in MALL?

Method

Bibliometric analysis involves quantitative evaluation of publications and their citations, enabling researchers to objectively map a field's structure (e.g. through citation networks, co-authorship networks, and productivity metrics). Using this approach allows us to explore both the "knowledge network" of MALL (who cites whom, which topics cluster together) and the "knowledge content" (what topics and ideas are prevalent and emerging). The use of bibliometric methods is well-justified given the volume of research spanning 15 years. Bibliometric analysis has proven valuable in CALL research: recent studies have employed mapping techniques to reveal hotspots and trends in broader CALL literature (Kartal & Yeşilyurt, 2024; Kopuz & Kartal, 2025). By doing the same specifically for MALL, we leverage a mature methodology to gain high-level insights into this subfield's development.

Data Sources and Collection

To compile a representative corpus of MALL literature (2011–2025), we retrieved bibliographic data from the Web of Science (Wos) Core Collection, specifically focusing on the Social Sciences Citation Index (SSCI) and most high-quality language education journals are indexed there. Using Web of Science ensures that we capture peer-reviewed, high-impact studies in the field. In addition, to maximize coverage, we limited our search to the years 2011 through 2025 inclusive; the end point (2025) included any publications up to the time of data collection.

The data for this study were retrieved from WoS by following a top-down approach. In the first place, we searched the publications regarding MALL from the WoS Core Collection including all the databases by using the search term. In the first place, we searched the publications regarding MALL from the WoS Core Collection on the SSCI database by using the following search terms: ALL= ("mobile" OR" mobile assisted language learning" OR "mobile learning" OR "m-learning" OR "MALL" OR "tablet" OR "mobile phone*" OR "cell phone*" OR "iPad" OR "mobile app*") AND ALL=("language learning" OR "language taching" OR "EFL" OR "ESL" OR "ELT" OR "L2" OR "second language*" OR "foreign language").

The initial search returned 4,114 records across all WoS indices. After filtering for journal articles only, the dataset was reduced to 2,684 items and restricting the time span to 2011–2025 yielded 2,440 publications. Next, the results were narrowed by applying WoS research-area filters, producing 1,502 items across five relevant categories (Education Educational Research, Linguistics, Language Linguistics, Psychology Educational, Education Special). To ensure high-quality coverage, only articles indexed in the SSCI were retained, resulting in 674 publications. Limiting the corpus to English-language articles further reduced the set to 667 records. A final manual relevance screening—verifying that each study genuinely addressed

MALL rather than general mobile education—produced a corpus of 415 articles, which served as the basis for subsequent bibliometric analyses. This multi-step filtering process ensured that the final dataset was focused, reliable, and representative of the MALL research landscape.

Data Analysis Procedures

Before the analysis, we performed data cleaning by creating thesaurus files. By doing so, we were able to avoid coding errors and merge variants of a term into a single unit. For instance, we turned "MALL" and "mobile-assisted language learning" into "mobile assisted language learning". Bibliometric analysis in this study incorporated quantification and knowledge mapping technology. Following data retrieval from the WoS database, we utilized the built-in analysis tool of WoS to investigate and quantify bibliometric indicators. These included the number of articles across years, citation counts, and author productivity. We then performed network analysis for knowledge mapping through VOSviewer software (Van Eck & Waltman, 2010). Network analysis constructs bibliometric networks and visualizations to reveal the scope and structure of the field in addition to key research clusters (Fahimnia et al., 2015). VOSviewer also served to identify the link strengths and relationships between authors, documents, and sources (Van Eck et al., 2010). In this study, we performed network analysis of citation, co-citation, and co-occurrence analyses.

Co-citation analysis, as a more insightful method for being not restricted to documents residing in a particular database (Hallinger & Kovačević, 2019). Two items are considered to have a co-citation relationship when they are cited together in a citing item's reference list (Osareh, 1996). Co-citation analysis of cited references identifies the most influential publications in a given research field, the core literature and their links to other documents and the domain's evolution path (Liao et al., 2018). Author co-citation analysis shows key authors in the field and indicates an intellectual affinity between two authors when they are often cited together in other documents (Small, 1999). In this study, we chose co-citation analysis instead of bibliographic coupling. This tendency is also available in many other bibliometric analyses (e.g., Chen, 2018; Shiau et al., 2015). In this analysis, the distance between two nodes indicates the strength of the relation between them, a shorter distance indicating a stronger link (Niñerola et al., 2019). In addition, the size of nodes represents their weights. The larger the node is, so is the weight. Finally, one color shows one cluster.

Findings

The findings are reported in line with the research questions. The study identified the most productive and influential sources, authors, and references and provided a summary of the most representative papers in the research field. Figure 1 shows the journals with highest numbers of publications.

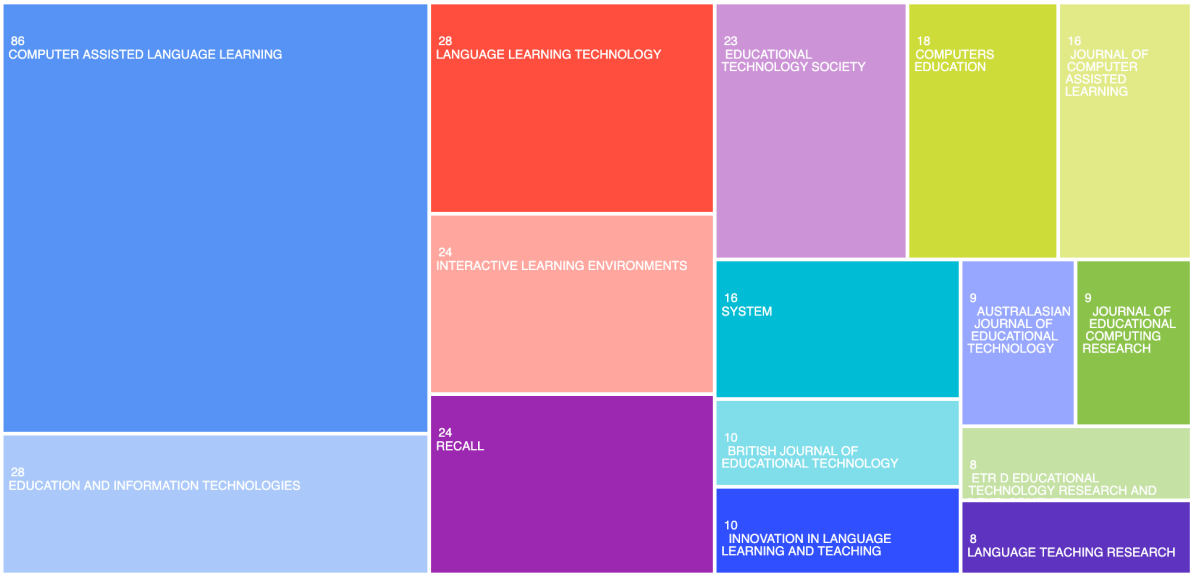

Figure 1: The most prolific journals.

Research themes

A keyword co-occurrence analysis was conducted using VOSviewer. All keywords indexed in the WoS database were included, and a threshold of seven occurrences was set to ensure the salience of the identified terms. Figure 2 depicts the co-occurrence analysis of keywords.

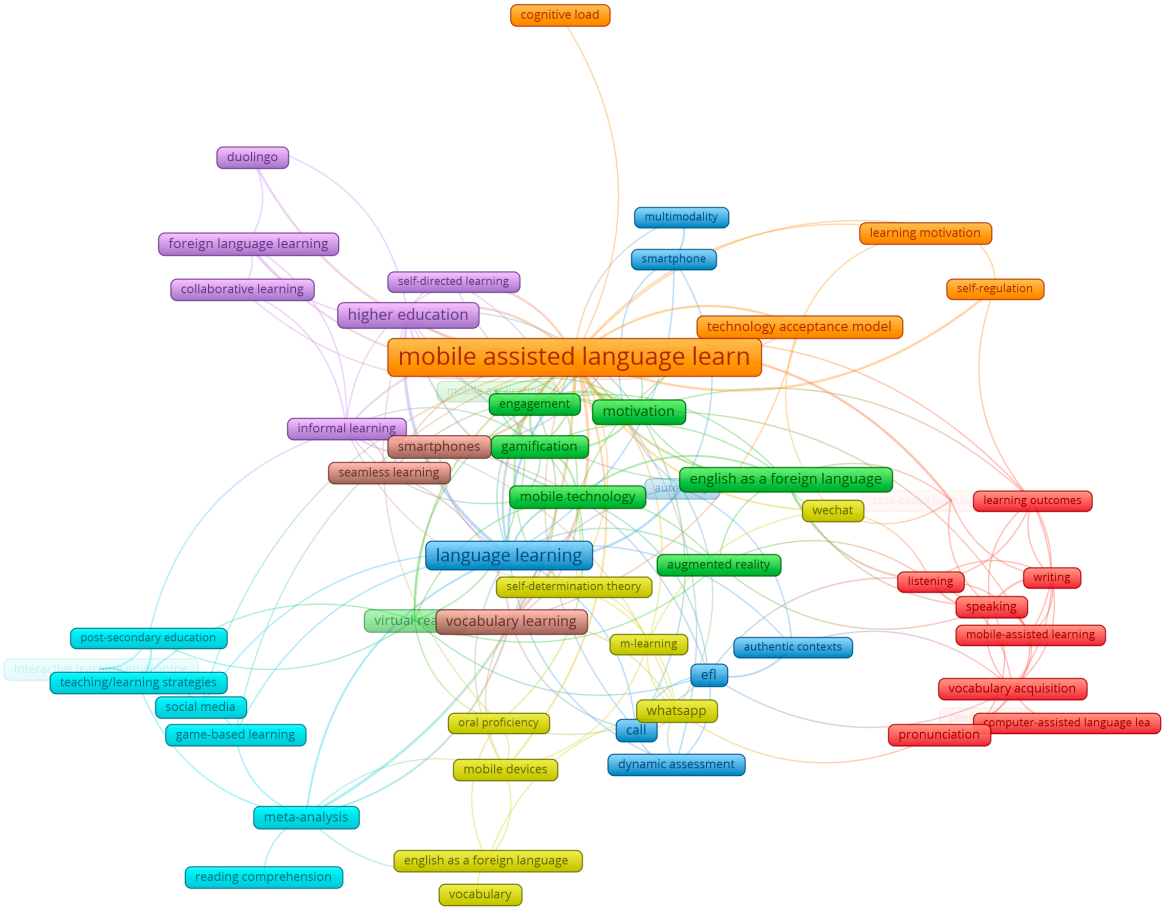

Figure 2. Co-occurrence analysis of keywords

The figure presents a visual map of how frequently keywords appear together in the MALL literature. At the centre of the map, “mobile assisted language learning” stands out as the dominant and most connected keyword. Its central position indicates that it serves as the main conceptual anchor of the field and links directly to a wide range of pedagogical, technological, and learner-related themes. The map reveals several clusters around this central concept. One major cluster includes keywords such as language learning, vocabulary, English as a foreign language, speaking, and reading. These terms appear close to each other, showing that many studies focus on improving core language skills through mobile tools. Vocabulary learning, in particular, emerges as one of the most frequently explored topics in the field.

Another important cluster is built around mobile technologies themselves. Keywords like mobile learning, mobile apps, mobile devices, and technology acceptance model indicate strong attention to the technological foundations of MALL. The frequent co-occurrence of these terms suggests that researchers are not only interested in learning outcomes but also in how usability, accessibility, and learners’ acceptance shape the effectiveness of mobile learning environments. A third cluster focuses on learner-related factors. Keywords such as motivation, engagement, and autonomy appear together, showing that the field pays growing attention to psychological and behavioural dimensions of mobile learning. This suggests that MALL is often studied not only as a tool for skill development but also as a means to increase

learner independence and sustained participation. Finally, pedagogical contexts form another visible cluster in the map. Terms like blended learning, collaborative learning, classroom, and higher education signal that MALL is widely integrated into both formal and informal instructional settings. This variety reflects the flexibility of mobile learning, which supports both structured classroom activities and self-directed learning beyond the classroom.

Overlay Visualization

The overlay visualization in Figure 3 illustrates how the thematic structure of MALL research has evolved over time.

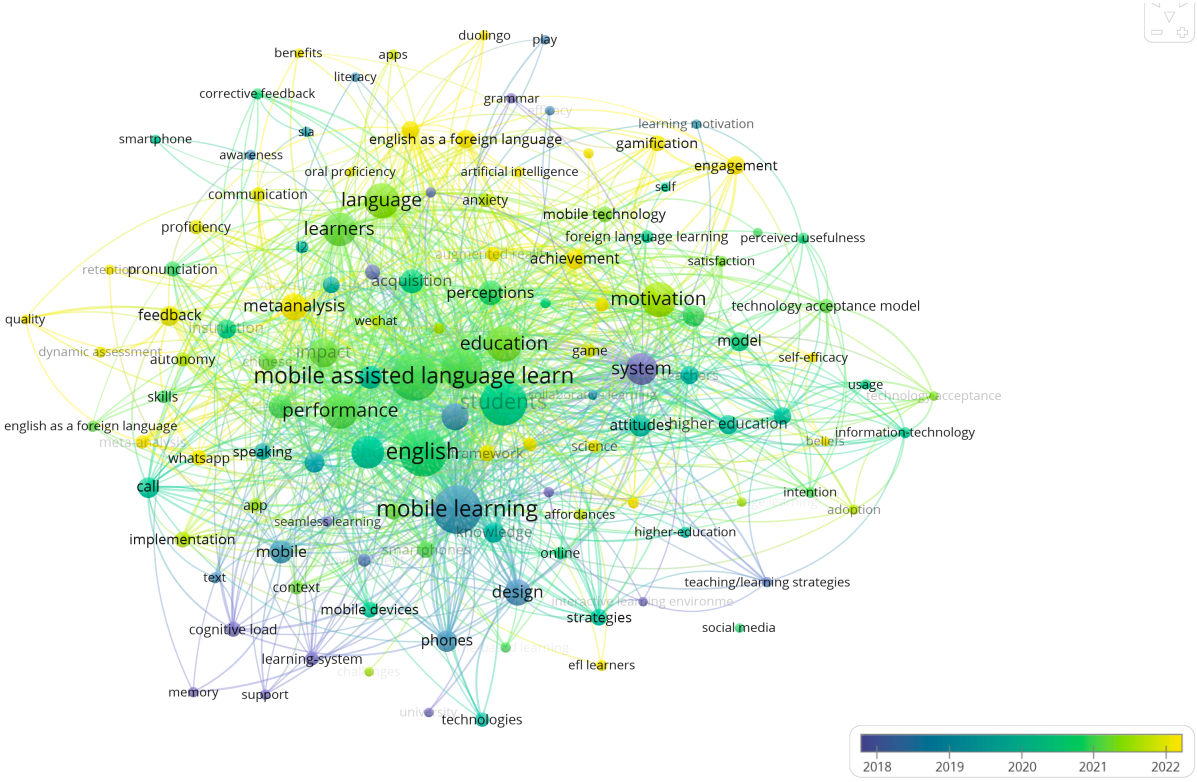

Figure 3. Overlay visualization

In this map, the colour scale represents the average publication year associated with each keyword, enabling a temporal reading of conceptual developments in the field. Keywords in darker tones (blue–green) reflect earlier research trends, while those in yellow shades indicate more recent lines of inquiry. Node size represents the frequency of keyword occurrence, and link strengths illustrate how closely related topics appear across the literature, following VOSviewer's standard mapping conventions. At the centre of the network, large nodes such as "mobile learning," "mobile assisted language learning," "english," "students," and "performance" demonstrate their role as the foundational concepts of the field. These terms appear predominantly in green tones, indicating that they were consistently studied throughout the 2010s and remain core pillars of MALL scholarship. Their dense connections show that early and mid-period studies focused on general mobile learning affordances, mobile device use, learning outcomes, and English as the primary target language. On the left

side of the map, clusters related to vocabulary learning, pronunciation, corrective feedback, autonomy, and WhatsApp-based learning appear in blue or blue-green tones. This indicates that these topics represent earlier phases of MALL research, particularly between 2011 and 2016. The strong internal links suggest that early studies focused heavily on discrete language skills, small-scale app or SMS-based interventions, and communication tools that were popular at the time (e.g., WhatsApp, WeChat).

Toward the upper-right section, keywords such as "gamification," "engagement," "anxiety," "motivation," "achievement," "learning motivation," and "perceived usefulness" appear in yellow-green tones. These colours indicate that these topics gained prominence in recent years, especially after 2019. Their emergence reflects a shift from tool-based evaluations to learner experience, affective variables, behavioural intention, and digital engagement. The strong connections to "technology acceptance model," "self-efficacy," and "usage" show that psychological and acceptance-based frameworks became increasingly influential in the later stages of MALL research. Another notable development is the appearance of "artificial intelligence" in a yellow shade, indicating that AI-related studies are among the most recent additions to the MALL landscape. Although still a smaller node compared to traditional topics, its position near gamification, motivation, and mobile technology suggests that AI is beginning to integrate with motivational and design-oriented research domains. This aligns with the emerging post-2022 trend of AI-driven language learning tools and intelligent mobile systems.

At the bottom of the map, terms such as "cognitive load," "learning system," "design," and "challenges" appear in earlier colours, reflecting foundational work on system design and cognitive considerations during the initial expansion of MALL. Their moderate link strengths suggest that although these themes were important in earlier years, they were gradually overshadowed by topics related to learner behaviour, engagement, and the pedagogical affordances of mobile tools.

Key Authors

To address the question of which authors have made significant contributions to the field of MALL, a co-citation analysis was conducted using VOSviewer (Figure 4).

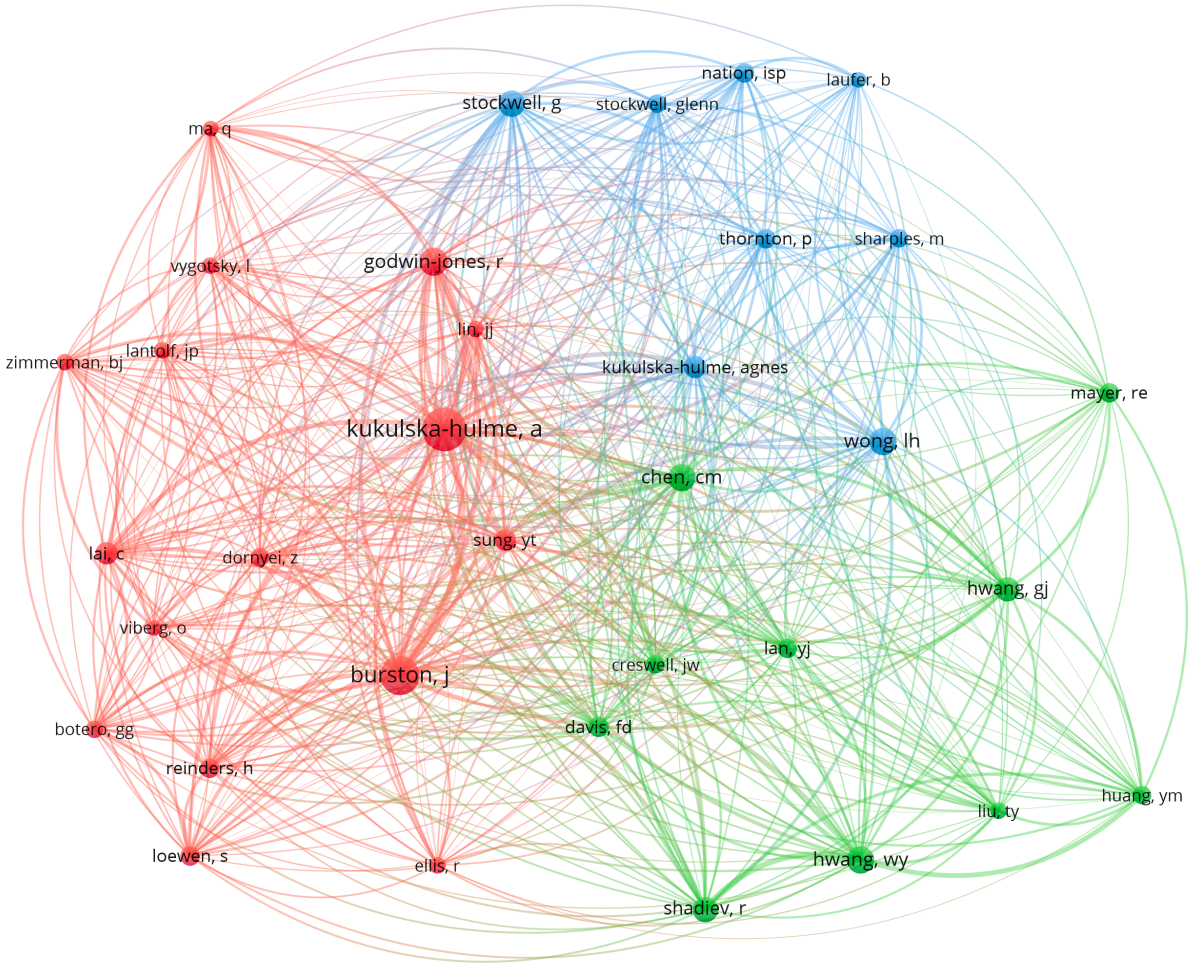

Figure 4. Co-citation analysis of authors

Figure 4 visualizes the co-citation network of authors whose works have shaped the MALL research domain. In line with VOSviewer's mapping principles, node size reflects the frequency with which an author is cited, link thickness indicates co-citation strength, and colours denote clusters of authors who are consistently cited together, representing shared intellectual traditions or thematic orientations within the field.vAt the centre of the network, Kukulska-Hulme A. and Burston J. appear as the most prominent nodes, indicating that they are the two most influential authors in the MALL research corpus. Their central spatial position and strong links across clusters show that their works form an intellectual bridge between multiple strands of MALL scholarship. Kukulska-Hulme's foundational contributions to mobile learning theory and mobile usability, and Burston's systematic reviews and evaluations of MALL implementations, make them the most widely co-cited scholars in the domain.

The map contains three major clusters, each representing a distinct but interconnected research tradition: Red cluster is dominated by Kukulska-Hulme A., Godwin-Jones R., Stockwell G., and Traxler J. Authors in this group are frequently co-cited because they contributed seminal work on the pedagogical affordances of mobile technologies, early

conceptualizations of mobile learning, and the transition from CALL to MALL. Their research typically focuses on mobile device potential, learner mobility, and early design principles. The density and cohesion of this cluster suggest that foundational theoretical and conceptual frameworks remain central in current MALL scholarship. The blue cluster includes authors such as Stockwell G., Thornton P., Wang Y., Wong L-H., and Liu T-Y. These scholars are frequently cited together for empirical investigations into mobile-mediated vocabulary learning, mobile task structure, and classroom-integrated mobile activities. Their research emphasizes pedagogical design, mobile-supported activities, and language learning outcomes. The proximity of this cluster to the red one shows that early theoretical work strongly informs task-design and pedagogical implementations. The third major cluster (green) includes Hwang G-J., Mei B., Hung C-M., and Sung Y-T—authors widely recognized for research on mobile learning systems, learner engagement, gamification, and technology acceptance. Their work is more data-driven and system-oriented, reflecting the growing intersection between MALL and broader mobile learning ecosystems. Strong co-citation links within this cluster demonstrate the influence of studies on mobile-supported engagement, self-regulated learning, and mobile-enhanced academic performance.

Key References

Figure 5 illustrates the core intellectual structure of MALL research by mapping the sources most frequently cited together. In this visualization, node size reflects citation frequency, link strength indicates how often two sources are co-cited, and colours represent distinct clusters of related scholarship. The network shows that a relatively small group of foundational publications shapes the majority of MALL studies.

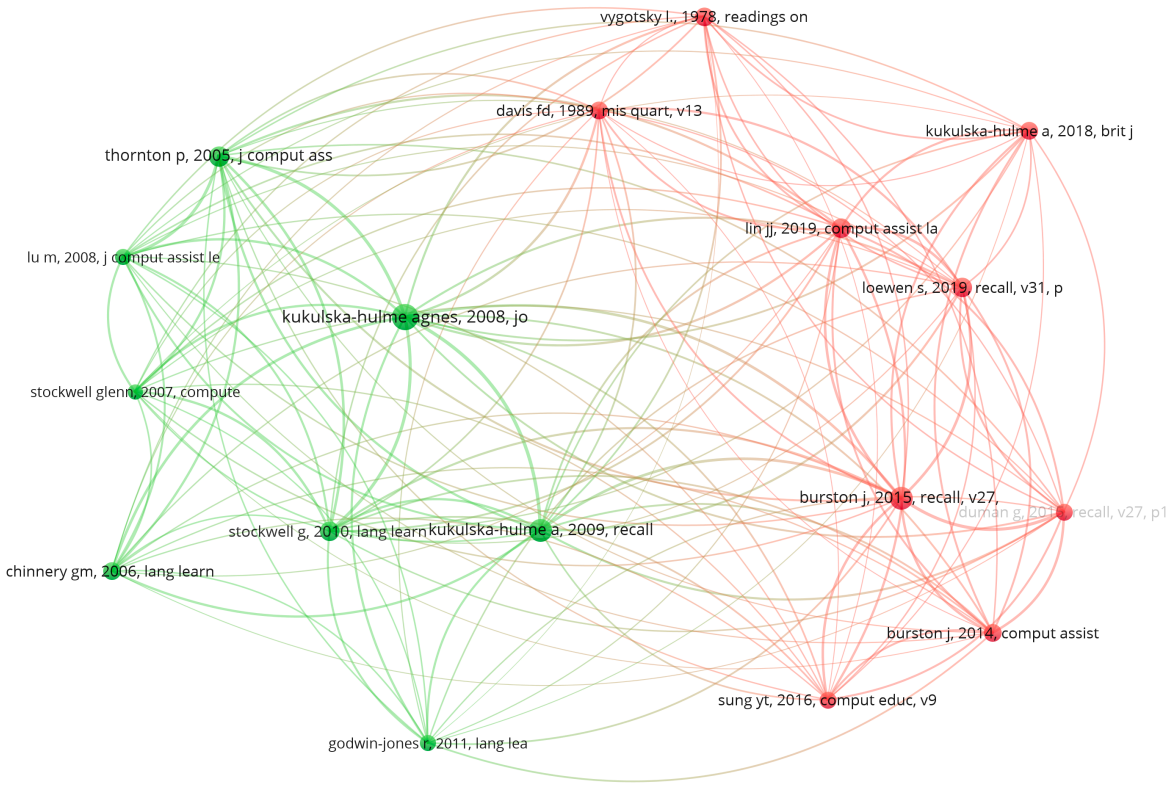

Figure 5. Co-citation analysis of key references

The red cluster represents the central and most influential body of work. Key sources such as Burston (2013, 2015, 2016) and Kukulska-Hulme & Shield (2008) dominate this cluster, indicating their role in defining early MALL frameworks and synthesizing the development of mobile learning. Their strong interconnections suggest that contemporary studies consistently rely on these foundational reviews and conceptual analyses. The green cluster contains pedagogically oriented and skill-focused research, including Stockwell (2008, 2010), Lu (2008), and Godwin-Jones (2011). These studies examine learners' mobile practices, vocabulary learning outcomes, and task design. Their tight grouping indicates that empirical, classroom-based investigations form a major strand of MALL scholarship. The blue cluster links MALL with broader educational technology theories, such as Davis (1989) on technology acceptance and Vygotsky (1978) on sociocultural learning. These works appear alongside mobile learning implementation studies (e.g., Thornton & Houser, 2005), reflecting the field's reliance on psychological and theoretical models to explain learner behaviour, motivation, and adoption.

Co-citation Analysis of MALL Research in the Last Three Years

Figure 5 presents the co-citation network for studies published in the last three years,

illustrating the most recent intellectual developments within the MALL field. As shown in the figure, artificial intelligence and related technologies—such as mobile applications, virtual reality, and augmented reality—have become central co-cited elements, indicating their growing influence on contemporary mobile-assisted language learning research. The map highlights how AI-enhanced approaches are increasingly integrated with established MALL themes, including self-regulation, vocabulary learning, blended learning, and mobile learning, demonstrating a clear shift toward data-driven and intelligent mobile learning environments in recent scholarship.

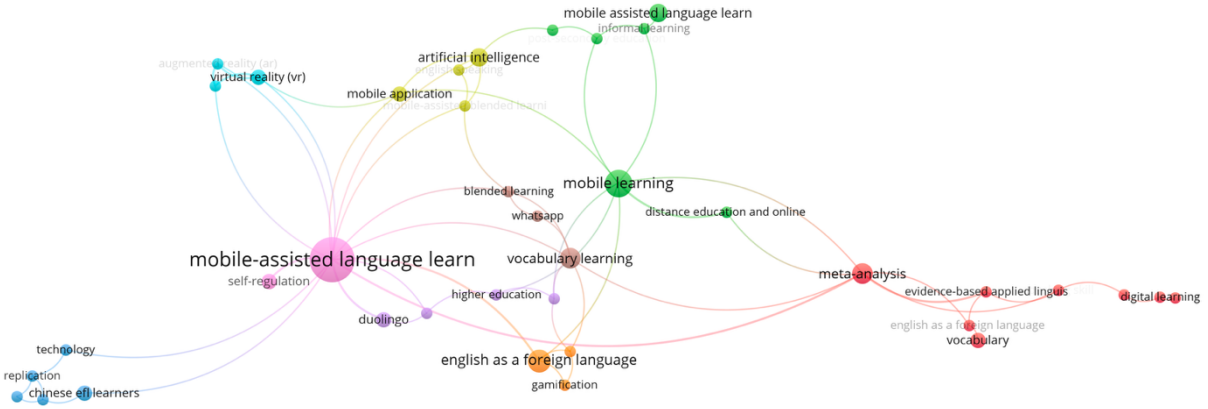

Figure 5. Co-occurance analysis of the years between 2023 and 2025

The co-citation network for the most recent three-year period reveals a clear shift in the intellectual structure of MALL research, with artificial intelligence (AI) emerging as a prominent and central theme. In contrast to earlier maps where foundational MALL sources dominated, the recent network shows AI-related terms—particularly “artificial intelligence,” “mobile application,” “virtual reality (VR),” and “augmented reality (AR)”—forming a distinct and increasingly influential cluster. The proximity of these nodes to “mobile-assisted language learning” indicates that AI-driven tools have become closely integrated with mainstream mobile learning practices. Their strong co-citation connections suggest that scholars are frequently citing AI-enhanced studies together with core MALL literature, signalling the consolidation of AI as a central strand of recent research.

The map also shows that AI is linked not only to traditional MALL topics but also to emerging pedagogical concerns. Terms such as “self-regulation,” “vocabulary learning,” “mobile learning,” and “blended learning” are tightly connected to AI-related sources, suggesting that researchers increasingly use AI frameworks to examine learner behaviour, personalised feedback, and adaptive mobile environments. This pattern highlights a methodological shift: AI is no longer treated as an experimental add-on but is positioned as a theoretical and analytical driver that shapes instructional design and learner modelling within mobile platforms.

In addition, the presence of Duolingo, WhatsApp, and "digital learning" as co-cited elements illustrates that AI-enhanced commercial or semi-commercial tools are now being incorporated into academic discourse. Their connections to AI indicate that recent studies explore how intelligent algorithms, gamification mechanics, and data-driven analytics support language learning within widely used mobile ecosystems. The link between AI and meta-analysis, located in the red cluster, further shows that systematic reviews increasingly synthesize evidence on AI-supported mobile learning, marking a move toward more evidence-based evaluations of AI's pedagogical effectiveness.

Discussion

The present bibliometric analysis provides a comprehensive overview of MALL research produced between 2011 and 2025, revealing how the field has evolved across four major technological and pedagogical phases. The results highlight three overarching trends: (1) the consolidation of mobile learning as a mainstream component of language education, (2) the diversification of research themes shaped by global and technological disruptions, and (3) the rapid emergence of AI-enhanced mobile learning as a defining direction for the near future.

Consistent with earlier reviews that located the origins of modern MALL research in the early 2010s (Burston, 2014; Duman et al., 2015), our analysis confirms that the period between 2011 and 2014 primarily focused on small-scale, skill-focused interventions—especially vocabulary learning, SMS-based tasks, and early app experimentation. The co-occurrence map shows that vocabulary, pronunciation, and SMS-mediated learning were central concepts in the earliest years, aligning with findings from Stockwell (2008, 2010) and Thornton and Houser (2005), whose works remain highly co-cited in the dataset. These foundational studies helped establish the pedagogical potential of mobile learning and formed the conceptual base on which later research expanded.

The second phase (2015–2018), which coincided with the global "app boom," confirms the substantial growth in app-based inquiry also noted by Karakaya and Bozkurt (2022). Research during this period shifted from exploratory experimentation to more systematic pedagogical investigation. Gamified applications, commercial platforms like Duolingo and Memrise, and early adaptive systems became widely studied, reflecting broader movements in educational technology toward personalization and user engagement (Godwin-Jones, 2017). Our mapping results show a strong clustering of terms such as mobile apps, mobile devices, performance, and motivation, indicating that learner engagement and usability became central concerns in this period.

The dramatic spike in publications between 2019 and 2021—visible in the annual output and keyword overlay—mirrors the unprecedented global reliance on digital and mobile learning tools during the COVID-19 pandemic. Similar to broader CALL trends (Wang et al., 2024; Mohsen et al., 2024), MALL research acted as a response mechanism, documenting how mobile platforms sustained instructional continuity in remote and hybrid settings. The frequent co-occurrence of terms such as online learning, blended learning, WhatsApp, and

engagement illustrates that mobile devices functioned as the backbone of emergency remote language teaching. This affirms claims that mobile learning supports flexibility and portability essential during educational disruptions (Kartal, 2019; Reinders & Pegrum, 2017).

One of the most important contributions of this review is identifying how artificial intelligence has rapidly reshaped the intellectual structure of MALL since 2022. The overlay visualization clearly shows "artificial intelligence," "chatbot," and "virtual/augmented reality" emerging in bright yellow hues—indicating very recent proliferation. The co-citation map for 2023–2025 further demonstrates that AI-related studies have become central to the field's newest research clusters. This aligns with global trends following the release of advanced conversational models such as ChatGPT, which have catalysed new possibilities for adaptive, dialogic, and personalized mobile learning (Kasneci et al., 2023).

The close connection between AI and constructs such as motivation, self-regulation, and engagement suggests that researchers are increasingly examining not only learning outcomes but also how AI-driven feedback, personalization, and multimodal interaction shape learner psychology. This reflects broader educational discussions on learner agency, emotional engagement, and cognitive support in AI-mediated environments (Holmes et al., 2019). Findings also reveal growing interest in immersive mobile learning through AR/VR, resonating with emerging claims that mobile mixed-reality environments offer context-rich opportunities for L2 learning.

Co-citation maps show three enduring intellectual anchors in MALL: (1) conceptual and theoretical frameworks (e.g., Kukulska-Hulme & Shield, 2008), (2) empirical task-design and vocabulary studies (Stockwell, Lu, Godwin-Jones), and (3) system-oriented educational technology works (Hwang, Hung, Sung). This tripartite structure suggests that MALL remains methodologically diverse, bridging pedagogical design, theoretical models, and system development. Interestingly, recent years show increased reliance on psychological and behavioural frameworks—particularly the Technology Acceptance Model (Davis, 1989), self-efficacy, and motivation theories—signalling a shift toward learner-centric evaluation and predictive modelling of mobile learning behaviours.

Conclusion

This bibliometric analysis provides a comprehensive overview of the development of MALL research between 2011 and 2025. This helped uncover how the field has expanded and diversified in response to technological, pedagogical, and global shifts. The findings show a clear trajectory from early skill-focused experiments to large-scale app-based practices, followed by a pandemic-driven surge in mobile learning adoption, and culminating in the recent integration of artificial intelligence and immersive technologies. Influential authors, journals, and references identified in the co-citation networks illustrate the intellectual foundations that have guided this progression, while the keyword analyses highlight the emergence of learner-centred, motivational, and AI-enhanced themes in contemporary scholarship. The study demonstrates that MALL has evolved into a mature and multifaceted research domain. Its growth reflects not only technological advancements but also changing learner needs, instructional contexts, and methodological approaches. As AI, AR/VR, and

data-driven personalization continue to shape digital learning environments, future MALL research will likely focus on adaptive learning systems, learner agency, and ethical considerations surrounding intelligent mobile technologies. By mapping the field's historical and emerging trends, this study offers a solid foundation for researchers and educators seeking to understand MALL's past developments and anticipate its future directions.

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