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iJIM International Journal of Interactive Mobile Technologies

iJIM | eISSN: 1865-7923 | Vol. 20 No. 17 (2026) | OPEN ACCESS

https://doi.org/10.3991/ijim.v20i17.61267

PAPER

# Mobile Technologies in English Language Education: A PRISMA-Guided Bibliometric Mapping of WoS-Indexed Research

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**ABSTRACT**

Mobile technologies are reshaping English language education, transforming traditional language teaching and learning through greater flexibility, accessibility, and interactivity. In this study, we conducted a bibliometric analysis of 264 peer-reviewed articles published between 2016 and 2025 in the Web of Science (WoS) Core Collection, following PRISMA guidelines. By examining publication trends, citation impact, keyword networks, and thematic evolution, our research maps the intellectual structure and developmental trajectory of mobile-assisted language learning (MALL) research in English language education. The findings reveal a steady increase in research output and influence, although scholarly contributions are concentrated within a limited number of journals, institutions, and countries. Four major thematic clusters are identified: learning performance; technology acceptance and instructional design; mobile-mediated interaction and feedback; and speaking and pronunciation development. Over time, the literature shows an increasing movement from application-oriented studies toward theory-driven adoption frameworks, alongside growing attention to intelligent support systems. Building on these insights, this study proposes a bibliometric-based conceptual synthesis of interaction-oriented MALL, showing how literature brings together technological affordances, learner-internal processes, and interactional dynamics in mobile language learning contexts.

**KEYWORDS**

mobile technologies, English language education, bibliometric analysis, thematic evolution, technology acceptance

## 1 INTRODUCTION

Mobile technologies have become an integral component of contemporary language education. Over the past decade, smartphones, mobile applications, and mobile-assisted language learning (MALL) platforms have reshaped instructional practices in

Zhou, B., Lim, S. P., Kabir, N., Prasantham, P., Miftah, M. Z. (2026). Mobile Technologies in English Language Education: A PRISMA-Guided Bibliometric Mapping of WoS-Indexed Research. *International Journal of Interactive Mobile Technologies (iJIM)*, 20(17), pp. 26–45. https://doi.org/10.3991/ijim.v20i17.61267

Article submitted 2026-02-24. Revision uploaded 2026-07-09. Final acceptance 2026-07-09.

English language education. Early applications positioned mobile devices as supplementary tools for vocabulary review, pronunciation practice, or classroom interaction [1], [2]. With the advancement of digital infrastructure and intelligent systems, mobile technologies have become increasingly integrated into instructional design, learner interaction, and performance monitoring. This shift reflects a transition from peripheral technological support to structural integration within learning environments.

The research on mobile technologies in English language education has expanded in both scope and volume. Studies have examined learning outcomes, learner motivation, technology acceptance, and classroom implementation, alongside increasing attention to AI-supported applications. Empirical evidence reports improvements in vocabulary acquisition, speaking performance, listening comprehension, and learner engagement in mobile-supported contexts [3]–[5]. Additional research indicates that mobile-supported approaches can support vocabulary and phrasal verb learning [6]. Meta-analytical findings further confirm the effectiveness of structured mobile learning approaches [7].

The theoretical work frequently draws on the technology acceptance model (TAM) to explain learner adoption and attitudes toward mobile learning systems [8], [9]. UTAUT-based models have also been applied to examine AI and mobile learning adoption in higher education [10]. Meanwhile, research on AI-powered applications, including adaptive feedback systems and conversational agents, highlights the growing attention given to personalised and data-informed instruction [11], [12]. Despite this expansion, the field remains conceptually fragmented. Research on learning performance, adoption frameworks, and AI-supported mechanisms often develops in parallel rather than through sustained theoretical integration. Consequently, the intellectual structure and theoretical orientation of the field remain insufficiently clarified, limiting a coherent understanding of its development. The existing narrative and systematic reviews provide valuable insights but typically focus on specific instructional effects or thematic domains [13], while the comprehensive mapping of research productivity, citation influence, and temporal thematic shifts remains limited.

To address this gap, this study conducted a bibliometric analysis of research on mobile technologies in English language education to examine its intellectual structure and research focus. It analyzed patterns of publication output, citation impact, and thematic development to clarify its organization and evolving research directions. Through bibliometric and temporal analysis, this study examines how the field has evolved and how emerging trends shape research directions. The study addresses the following research questions:

**RQ1:** What are the publication and citation trends in research on mobile technologies in English language education between 2016 and 2025?
**RQ2:** Which authors, journals, institutions, and countries demonstrate the highest levels of productivity and citation impact in this field?
**RQ3:** What are the major thematic clusters in the field, and how have these themes evolved over time?

## 2 METHOD

### 2.1 Research design

This study examines how mobile technologies have developed in English language education through bibliometric analysis. Bibliometric analysis is a quantitative

research method based on structured bibliographic data, in which publications are treated as the units of analysis. Statistical indicators are used to identify publication trends, citation patterns, and thematic evolution over time [14]. Compared with narrative reviews, bibliometric methods rely on reproducible indicators, which contribute to methodological consistency and analytical rigor [15]. Such approaches have been widely used to map intellectual structures in educational research [16] and have also been applied in recent bibliometric studies on mobile and digital learning [17], [18]. However, there is still a limited application of these approaches to mobile technologies in English language education. This study focuses on MALL and examines publication output and thematic development. Research structures and trends are further explored through a combination of performance analysis, keyword co-occurrence network mapping, timeline visualisation, and keyword burst detection.

## 2.2 Data collection

All bibliographic records used in this study were retrieved from the Web of Science (WoS) Core Collection on February 11, 2026. We selected WoS as the sole data source because of its broad coverage, consistent indexing, and established citation network. The search was conducted using the Topic Search (TS) field, combining keywords related to mobile technologies and English language education with Boolean operators. Terms within each concept group were connected using OR, whereas the two concept groups were linked using AND. No filters concerning publication year, document type, WoS index coverage, or language were applied during the initial search. The search query was as follows:

TS = (("mobile technology*" OR "mobile learning" OR "mobile-assisted language learning" OR MALL OR "mobile-based learning" OR "interactive mobile technology" OR "mobile interactive learning" OR "mobile applications" OR "mobile app*" OR "mobile devices" OR "smartphone-based learning") AND ("English education" OR "English language education" OR "English language learning" OR "English as a foreign language" OR "EFL" OR "English as a second language" OR "ESL" OR "teaching English to speakers of other languages" OR "TESOL" OR "English language teaching" OR "ELT")).

Table 1 presents the complete search strategy used for data retrieval.

**Table 1.** Search strategy for data retrieval

| Item | Description |
|---|---|
| Initial filters | None |
| Database | WoS Core Collection |
| Search field | Topic Search (TS) |
| Search string | (("mobile technology*" OR "mobile learning" OR "mobile-assisted language learning" OR MALL OR "mobile-based learning" OR "interactive mobile technology" OR "mobile interactive learning" OR "mobile applications" OR "mobile app*" OR "mobile devices" OR "smartphone-based learning") AND ("English education" OR "English language education" OR "English language learning" OR "English as a foreign language" OR "EFL" OR "English as a second language" OR "ESL" OR "teaching English to speakers of other languages" OR "TESOL" OR "English language teaching" OR "ELT")) |
| Retrieval date | February 11, 2026 |

## 2.3 Study selection

The retrieved records were screened sequentially according to predefined eligibility criteria concerning publication year, document type, WoS index coverage, language, and topical relevance. The study selection and screening process followed the PRISMA guidelines [19], as illustrated in Figure 1. This process included identification, screening, eligibility, and inclusion. Initially, 788 records were identified in the WoS Core Collection. After limiting the publication period to 2016–2025, 125 records were removed for falling outside the specified range. The remaining 663 records were screened according to document type and WoS index coverage. Consequently, 145 records were excluded. Of these, 45 were excluded because they were not classified as articles. A further 100 records were not indexed in either the social sciences citation index (SSCI) or the science citation index expanded (SCI-EXPANDED).

The remaining 518 records were then assessed for eligibility, resulting in the exclusion of 254 records. One was removed because it was not written in English, while the remaining 253 were manually excluded following an assessment of topical relevance based on their titles, abstracts, and keywords. These records were classified as out of scope because they did not align with the study's focus on mobile technologies in English language education. Specifically, these exclusions included 132 publications that were not related to English language education and 76 studies that lacked a clear MALL or mobile technology component. They also included 41 papers that examined languages other than English as the target language and four articles that addressed general educational technology without a specific MALL focus. A detailed breakdown of the exclusion reasons during eligibility assessment is presented in Table 2. Ultimately, 264 articles fulfilled the inclusion criteria and were selected for the final bibliometric analysis.

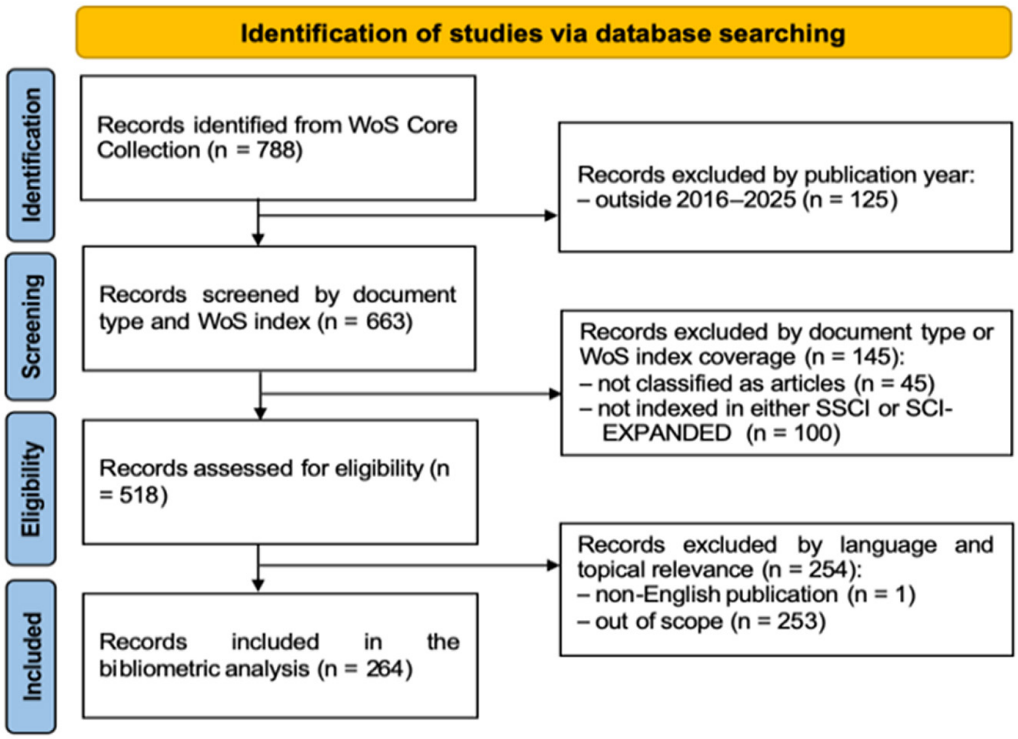


**Fig. 1.** PRISMA flowchart

*Source:* Adapted from Page et al. [19].

**Table 2.** Breakdown of exclusions by reason during eligibility assessment

| Main Category | Specific Reason | No. |
|---|---|---|
| Out of scope | Not related to English language education | 132 |
| | No specific MALL or mobile technology component | 76 |
| | Focused on languages other than English | 41 |
| | General educational technology only | 4 |
| Language | Not written in English | 1 |
| Total | | 254 |

*Notes:* The four "out of scope" reasons sum to 253; together with one non-English article, the total number of excluded records is 254.

## 2.4 Data analysis

Data analysis was carried out using VOSviewer (version 1.6.20), CiteSpace (version 6.4.R1, 64-bit Advanced), Microsoft Excel, and Datawrapper. The dataset was exported in both plain-text and Excel formats. The plain-text file was imported into VOSviewer to construct the keyword co-occurrence network. The All keywords option was selected, combining Author Keywords and Keywords Plus from the WoS records. Title and abstract terms were not included. Before network generation, the keyword data were manually reviewed and standardized using a thesaurus file prepared in the format required by VOSviewer. The file mapped variant terms to their preferred labels and was imported into VOSviewer during the analysis. Synonymous terms, hyphenation variants, and abbreviations referring to the same concept were consolidated under a single preferred label. For example, "mobile-assisted language learning," "mobile assisted language learning," and "MALL" were consolidated as "mobile-assisted language learning." Generic terms were retained during keyword standardization. Full counting was applied, with a minimum occurrence threshold of 8, resulting in 53 keywords grouped into four clusters.

Microsoft Excel was used to organize the bibliographic data, prepare the thesaurus file, extract indicators, and produce descriptive visualizations. Performance indicators were calculated using publication and citation data for five dimensions: highly cited publications, core journals, influential authors, leading institutions, and productive countries. Datawrapper generated geographical maps of the national research contributions. CiteSpace was applied for keyword timeline visualisation and keyword burst detection. For the keyword timeline analysis, the time span was set from 2016 to 2025, with a one-year time slice and keywords selected as the node type. Node selection was based on the g-index with $k = 15$, and Pathfinder pruning was applied to simplify the network. Timeline analysis traced the temporal evolution of thematic clusters, whereas keyword burst analysis identified keywords that experienced rapid increases in occurrence during specific periods. Keyword bursts were detected using the Kleinberg algorithm. The burst detection model was configured with two states, $\gamma = 0.7$, and a minimum burst duration of two years. The initial-state ratio and the successive-state ratio were both set to 2.0. Under these settings, 14 keywords with the strongest bursts were identified.

# 3 RESULTS

## 3.1 Publication and citation trends

Table 3 reports the core bibliometric metrics of the dataset retrieved from the WoS database for the period 2016–2025. The dataset includes 264 publications, generating 6,536 citations (6,130 excluding self-citations) and 4,637 distinct citing articles. On average, each publication received 24.76 citations, and the overall h-index reached 44. Figure 2 further shows the annual trends in publication output and citation counts during the study period. After a temporary decline in 2018, publication output increased from 2019 to 2022 and reached a peak of 50 publications in 2022. It subsequently fluctuated at a relatively high level between 2023 and 2025. Annual citation counts also increased substantially and reached their highest level at approximately 1,500 citations in 2025.

These metrics and annual trends suggest that research on mobile technologies in English language education has evolved into an increasingly established field. The citation counts and number of citing articles further indicate sustained scholarly interest in the field. However, the average citation rate should be interpreted cautiously, as citation impact may be concentrated among a relatively small number of highly cited early publications. These publications have benefited from longer citation windows and may therefore disproportionately influence the overall metrics. Accordingly, citation-based metrics should be interpreted as indicators of scholarly visibility and intellectual influence rather than direct measures of research quality.

**Table 3.** Core bibliometric metrics from WoS

| Metric | Value (2016 to 2025) |
|---|---|
| Total publications | n = 264 |
| Total citing articles | 4,637 |
| Total citations | 6,536 (6,130 excluding self-citations) |
| Average citations per item | 24.76 |
| H-index | 44 |

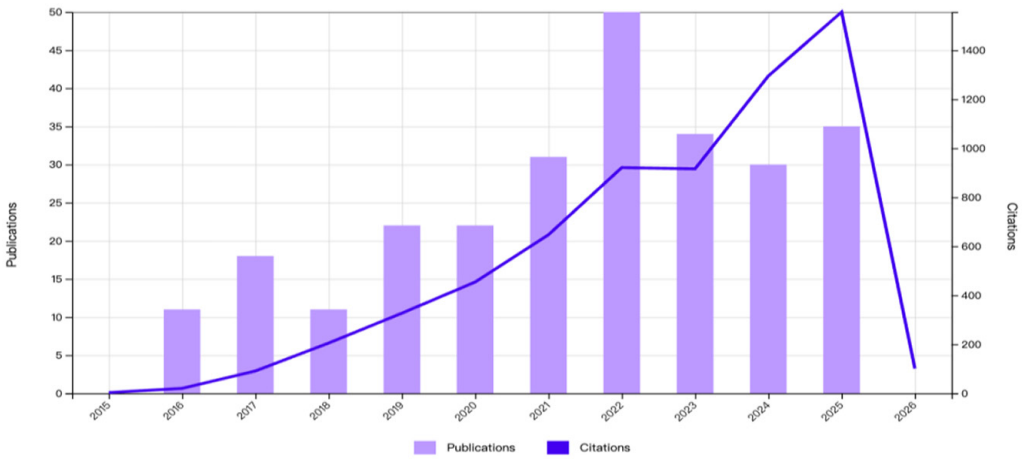


**Fig. 2.** Annual publications and citations from WoS

## 3.2 Documents

Table 4 presents the 10 most cited publications in Mobile Technologies in English Language Education. Sung et al. [20] ranks first with 820 citations, far exceeding the other studies in the dataset. The second most cited study, Shadiev et al. [21], received 130 citations, followed by Ahn and Lee [22] and Hsu [23], with 112 and 98 citations, respectively. A clear citation gap exists between the top-ranked publications and the remaining works, with citation counts ranging from 57 to 130, indicating an uneven distribution of research influence. In terms of publication timing, the most highly cited studies were published between 2016 and 2018, which highlights the lasting impact of early research on the field.

**Table 4.** Most cited publications

| Author | Titles | Cites |
|---|---|---|
| Sung et al. [20] | The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis | 820 |
| Shadiev et al. [21] | Review of research on mobile language learning in authentic environments | 130 |
| Ahn & Lee [22] | User experience of a mobile speaking application with automatic speech recognition for EFL learning | 112 |
| Hsu [23] | Examining EFL teachers' technological pedagogical content knowledge and the adoption of mobile-assisted language learning: a partial least square approach | 98 |
| Dashtestani [24] | Moving bravely towards mobile learning: Iranian students' use of mobile devices for learning English as a foreign language | 87 |
| Chen et al. [25] | The effects of using mobile devices on language learning: a meta-analysis | 84 |
| Hsu et al. [26] | Proposing a task-oriented chatbot system for EFL learners speaking practice | 83 |
| Hsu & Lin [27] | Extending the technology acceptance model of college learners' mobile-assisted language learning by incorporating psychological constructs | 78 |
| Klimova [28] | Mobile phones and/or smartphones and their apps for teaching English as a foreign language | 75 |
| Dai & Wu [29] | Mobile-assisted pronunciation learning with feedback from peers and/or automatic speech recognition: a mixed-methods study | 57 |

## 3.3 Journals

The journal performance data in Figure 3 shows that *Computer Assisted Language Learning*, with 39 publications, is the most productive and influential source in this domain, accumulating 1,479 citations. It is the leading journal in the field, playing a central role in both publication output and citation impact. *Education and Information Technologies*, which published 39 articles, and *Interactive Learning Environments*, with 13 publications and 400 citations, form the next group of influential sources, showing strong citation performance but at a lower level than the leading journal. Although several journals publish a similar number of articles, the differences in citation counts reflect variations in their academic visibility and influence. In general, the research impact in this field is concentrated in a small number of core journals.

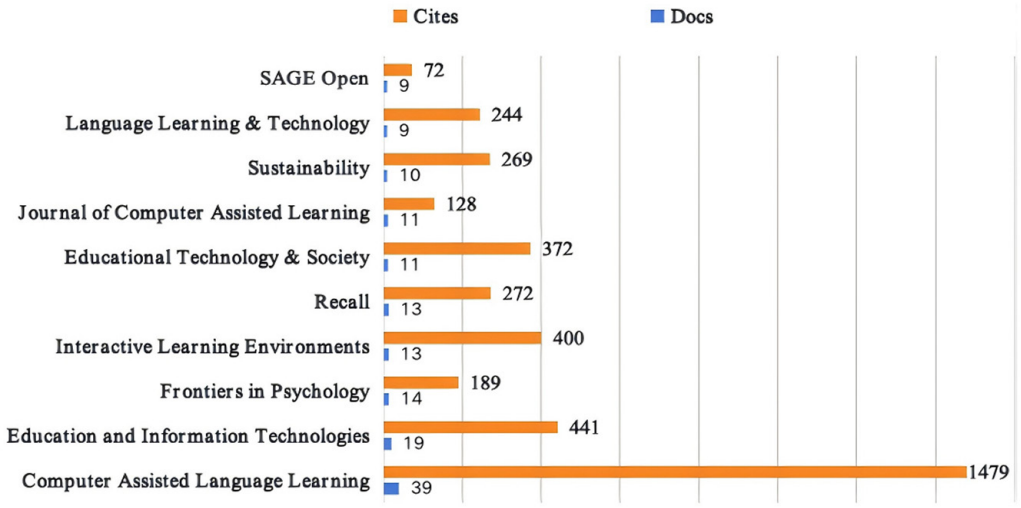


**Fig. 3.** Top 10 most cited journals

## 3.4 Authors

In terms of individual contributions, Figure 4 illustrates the authors with the highest citation counts in the field. Wu, Wen-Chi Vivian stands out with 296 citations despite a limited number of publications, suggesting a high average citation impact. In contrast, Hwang, Wu-Yuin is the most productive author, with 10 publications and 289 citations. Hwang, Gwo-Jen has 211 citations and five publications, and is also a highly influential contributor. This comparison shows that influence in the field is not limited to the most prolific authors, and that both high productivity and strong citation impact can be observed.

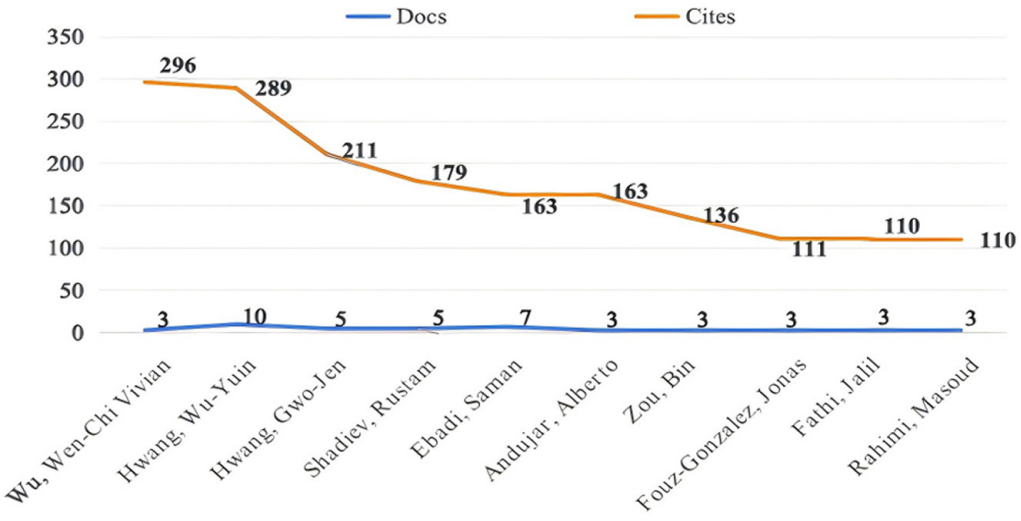


**Fig. 4.** Top 10 most cited authors

## 3.5 Institutions

The performance analysis further identifies the leading institutions contributing to research on mobile technologies in English language education. Figure 5 displays the top 10 institutions with the highest citation counts in this domain. National Taiwan Normal University has the highest citation impact, with 1,150 citations across nine publications, which suggests a concentrated citation pattern. By comparison, National Central University is the most productive institution, publishing 13 articles and receiving 691 citations, indicating strong output alongside solid citation performance. Several other institutions, including Razi University with nine publications and 166 citations, and Islamic Azad University with six publications and 163 citations, show comparable productivity but a lower citation impact. Institutional influence appears to be shaped by both publication scale and citation impact, rather than output volume alone.

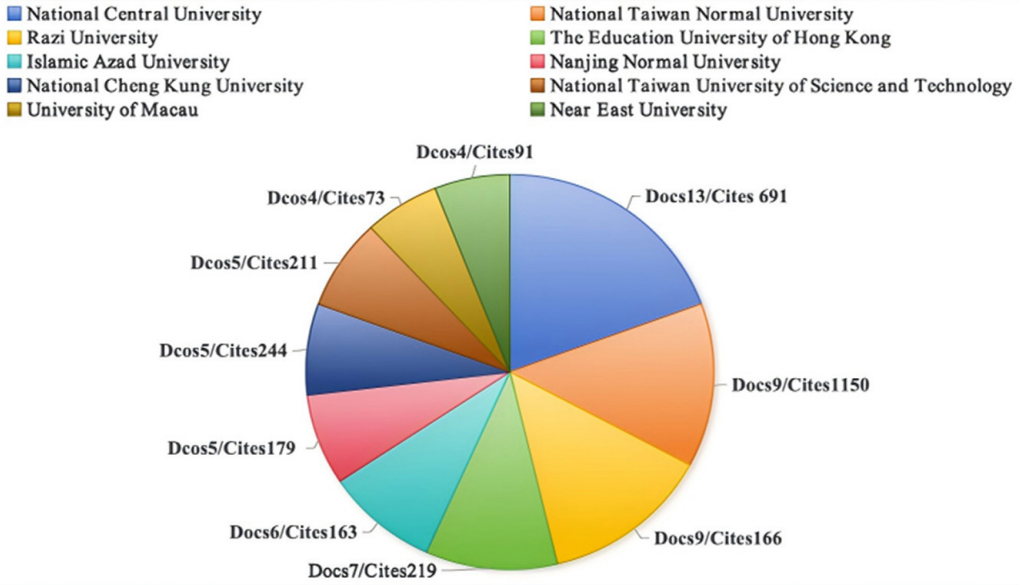


**Fig. 5.** Top 10 most cited institutions

## 3.6 Countries

Geographically, Figure 6 depicts the countries with the highest publication output and citation counts in the field. China recorded the highest publication output, with 150 publications, and the highest citation count, with 4,634 citations. The United States, with 23 publications and 788 citations, and Iran, with 35 publications and 634 citations, were also among the major contributing countries. Several other countries, including Spain, Turkey, and South Korea, showed moderate publication output with comparatively lower citation accumulation. Overall, publication and citation activity appeared to be concentrated in a limited number of countries, suggesting an uneven global distribution of research contributions.

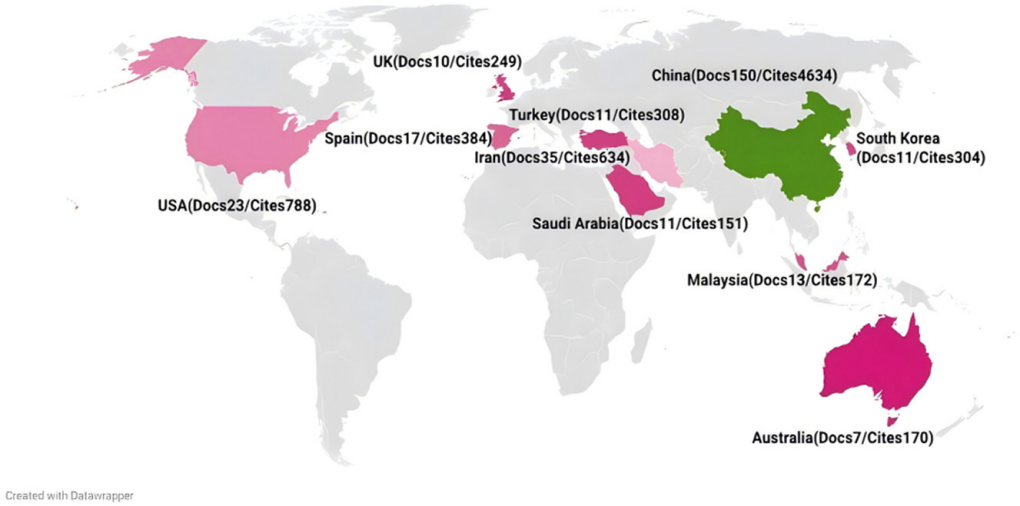


**Fig. 6.** Top 10 most cited countries

## 3.7 Keyword co-occurrence and thematic clustering

Figure 7 shows the keyword co-occurrence network generated using VOSviewer. Four thematic clusters were identified. The network reveals how research on mobile technologies in English language education has developed across several interrelated areas. A strong concentration is observed around the MALL framework, particularly in relation to learning outcomes, pedagogical design, technological mediation, and speaking skill development. These clusters outline the main research directions in the mapped literature and reflect growing scholarly attention to the integration of technological innovation with learner-centered instructional practices. The detailed cluster composition and representative keywords are presented in Table 5.

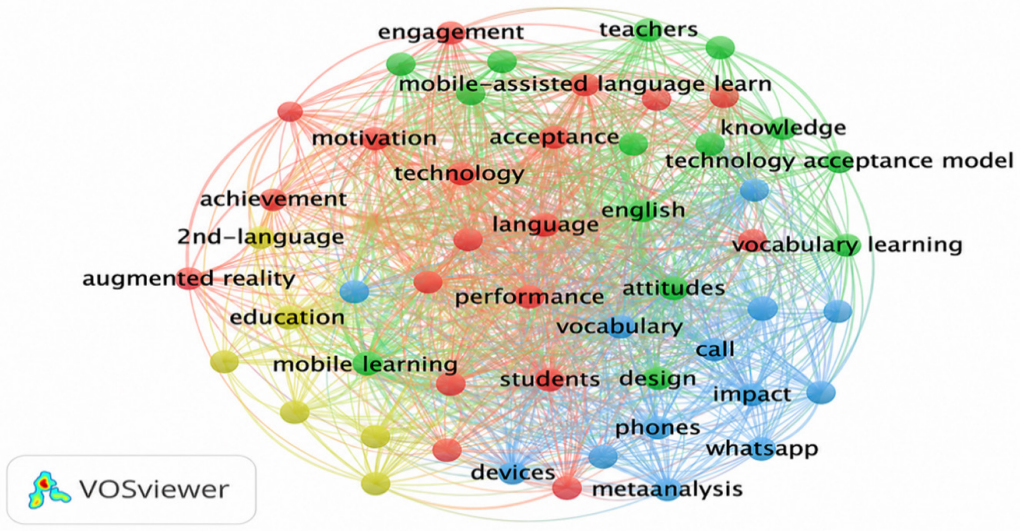


**Fig. 7.** Keyword co-occurrence network (VOSviewer)

Cluster 1 (Red), comprising 19 keywords, focuses on learning outcomes and performance enhancement within MALL contexts. The prevalence of keywords such as "mobile-assisted language learning," "EFL learners," "students," "performance," "achievement," and "strategies" underscores a strong research focus on measurable

educational impact. These keywords suggest that studies in this cluster frequently discuss learner achievement and skill acquisition in relation to mobile technologies. Moreover, the prominence of "motivation" and "engagement" highlights researchers' attention to the affective dimensions that shape learning outcomes. The presence of "system" further indicates the use of structured digital platforms to support, monitor, and enhance learner progress.

Cluster 2 (Green), with 15 keywords, centers on technology acceptance and instructional implementation within MALL contexts. This cluster delves into how mobile technologies are adopted and pedagogically integrated into language teaching and learning environments. Key terms such as "attitudes," "teachers," "mobile learning," and "vocabulary learning" reflect the broader pedagogical and learner-related concerns within this cluster. The recurring focus on "technology acceptance model" and "user acceptance" highlights the importance of learner and teacher attitudes in technology adoption. The combination of "design" and "instruction" points to the structured integration of mobile technologies within teaching practices.

**Table 5.** Keyword co-occurrence clusters in MALL research

| Cluster & Color | Cluster Label | No. of Keywords | Representative Keywords |
|---|---|---|---|
| 1 (Red) | Learning Outcomes and Performance in MALL | 19 | "Mobile-assisted language learning," "EFL learners," "Students," "Motivation," "Performance," "Engagement," "Achievement," "System," "Strategies" |
| 2 (Green) | Technology Acceptance and Instructional Design in MALL | 15 | "Technology acceptance model," "User acceptance," "Attitudes," "Teachers," "Instruction," "Design," "Mobile learning," "Vocabulary learning" |
| 3 (Blue) | Mobile-Mediated Interaction and Feedback Mechanisms | 13 | "Mobile devices," "Smartphones," "Phones," "WhatsApp," "Feedback," "Perceptions," "Challenges" |
| 4 (Yellow) | Speaking and Pronunciation Development in MALL | 6 | "English as a foreign language," "Mobile technology," "Pronunciation," "Speaking" |

Cluster 3 (Blue), consisting of 13 keywords, revolves around the communicative and interactive functions of mobile technologies. Representative keywords, including "mobile devices," "smartphones," "phones," and "feedback," suggest that this cluster emphasizes real-time interaction, peer collaboration, and feedback exchange in mobile-supported learning environments. The inclusion of platforms such as "WhatsApp" indicates the integration of social communication tools into language learning contexts. Attention to "perceptions" and "challenges" further reflects concerns related to user experience, usability, and contextual constraints.

Cluster 4 (Yellow), including 6 keywords, addresses oral skill development in EFL contexts. Keywords such as "English as a foreign language," "pronunciation," and "speaking" signify a research emphasis on productive language skills within mobile-supported learning environments. Although this cluster contains fewer keywords, it represents a distinct thematic orientation toward speaking and pronunciation. This orientation suggests that speech practice, pronunciation training, and oral performance assessment have become visible topics in the mapped MALL literature.

## 3.8 Temporal evolution of research themes

Figure 8 presents a timeline visualization of the keyword co-occurrence network from 2016 to 2025, tracing the temporal evolution of the major research themes.

The network shows strong modularity (Q = 0.68) and a high silhouette value (S = 0.87), indicating well-defined and internally consistent thematic clusters. During 2016–2018, the largest cluster, cluster #0 (mobile-assisted language learning), together with cluster #1 (English language learning), dominated the research activity with a focus on mobile technology applications in language education. Between 2019 and 2021, cluster #3 (technology acceptance model) became more prominent, with increased attention on learner adoption frameworks. From 2022 onward, cluster #4 (intelligent personal assistant) emerged and expanded, indicating a growing interest in intelligent support functions within mobile learning environments. Overall, the timeline analysis indicates a bibliometric shift from application-focused research towards theory-oriented clusters and emerging intelligent support functions.

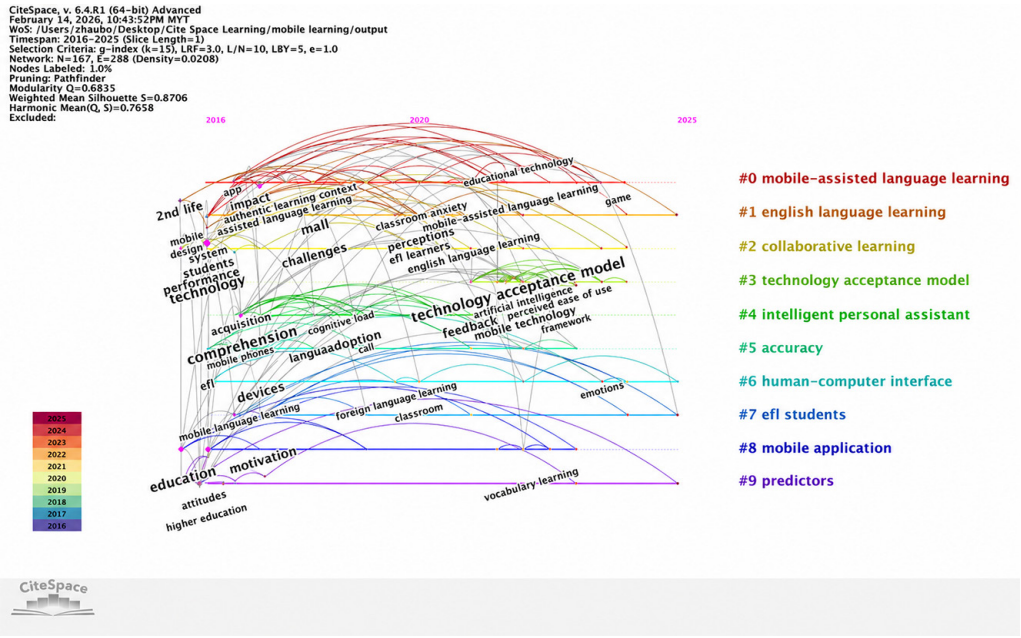


**Fig. 8.** Keyword timeline network (CiteSpace)

## 3.9 Keyword burst analysis

Keyword burst analysis further reflects shifts in research attention across different periods. Table 6 displays the 14 keywords with the strongest bursts between 2016 and 2025. Among these, devices showed the highest burst strength (2.95), followed by MALL (2.59) and language learning (2.08). Early bursts were observed for language learning (2016–2020; 2.08) and collaborative learning (2016–2017; 1.70). These burst patterns point to a research focus on language learning and collaborative learning during the early years of the study period. Between 2022 and 2023, new bursts appeared for vocabulary learning (1.99), perceived usefulness (1.87), higher education (1.72), and user acceptance (1.50), suggesting a diversification of research attention across learning content, educational contexts, and technology acceptance. TAM (2022–2025; 1.48) and strategy (2023–2025; 1.53) remained active through 2025, indicating a sustained focus on adoption frameworks and learning strategies.

**Table 6.** Keywords with the strongest bursts (CiteSpace)

| Keywords | Year | Strength | Begin | End | 2016–2025 |
|---|---|---|---|---|---|
| language learning | 2016 | 2.08 | **2016** | 2020 | |
| collaborative learning | 2016 | 1.70 | **2016** | 2017 | |
| MALL | 2016 | 2.59 | **2018** | 2020 | |
| phones | 2019 | 1.79 | **2019** | 2022 | |
| instruction | 2020 | 1.85 | **2020** | 2021 | |
| devices | 2017 | 2.95 | **2021** | 2022 | |
| online | 2021 | 1.63 | **2021** | 2022 | |
| English language learning | 2021 | 1.63 | **2021** | 2022 | |
| vocabulary learning | 2022 | 1.99 | **2022** | 2023 | |
| perceived usefulness | 2022 | 1.87 | **2022** | 2023 | |
| higher education | 2016 | 1.72 | **2022** | 2023 | |
| user acceptance | 2022 | 1.50 | **2022** | 2023 | |
| TAM | 2022 | 1.48 | **2022** | 2025 | |
| strategy | 2021 | 1.53 | **2023** | 2025 | |

# 4 DISCUSSION

The bibliometric findings suggest that research on mobile technologies in English language education is moving beyond a primary focus on performance outcomes. Keyword patterns and thematic clusters show increasing scholarly attention to technology acceptance, motivation, and engagement [4], [11], [30]. This shift suggests that the field is increasingly concerned not only with learning outcomes but also with the processes through which learners accept, engage with, and interact in mobile learning environments. The keyword burst and timeline analyses also show the emergence of intelligent personal assistant technologies and sustained attention to feedback, suggesting increasing scholarly interest in individualized support, especially in speaking and vocabulary learning [31]. In addition, publication and citation patterns reveal regional differences in research output and citation counts. As a broader interpretation, these differences may be associated with variations in institutional resources, technological infrastructure, and policy support [32]. However, the bibliometric evidence alone cannot establish these factors as causal explanations for the observed regional patterns.

## 4.1 Theoretical implications

Building on these findings, this study contributes to the conceptual development of research on mobile technologies in English language education. It does so by reframing MALL within interactive mobile application environments. In much of the existing MALL literature, mobile technologies are commonly treated as instructional tools. Research has also tended to focus on learning outcomes or on learners' willingness to adopt mobile technologies [20], [23], [25]. Although TAM remains useful for explaining

why learners initially accept mobile learning systems [33], [34], it offers less direct insight into post-adoption issues, such as interaction, engagement, and learner support [27], [35]. Therefore, adoption-based perspectives alone provide a limited basis for interpreting mobile learning beyond initial acceptance. By mapping these thematic shifts, this study adds to existing MALL and TAM-oriented literature. It moves beyond a primary focus on technology acceptance toward a broader conceptual understanding of engagement, feedback, intelligent support, and learner-system interaction.

Based on these bibliometric patterns, the proposed framework is organized around three dimensions shown in Figure 9, namely technological affordances, learner-internal processes, and interactional dynamics. These dimensions are derived from the bibliometric findings, particularly keyword co-occurrence and thematic clustering, the temporal evolution of research themes, and keyword burst analysis. Technological affordances are grounded in themes of mobile devices, feedback, platform use, instructional design, and emerging intelligent support. Learner-internal processes are informed by themes related to motivation, engagement, attitudes, perceptions, perceived usefulness, and user acceptance. Interactional dynamics are reflected in the mapped literature on mobile-mediated interaction, peer collaboration, WhatsApp-supported communication, and feedback exchange. Thus, the framework should be understood as a conceptual synthesis of bibliometric patterns rather than as a validated theoretical or explanatory model. This study does not claim to prove learner-system mechanisms, classroom effectiveness, or causal learning processes.

The framework may also provide a useful conceptual lens for interpreting mobile technology-supported learning in English language education. In this sense, the framework integrates the broader conceptual themes identified in the bibliometric findings. The technological affordances dimension, for instance, illustrates this broader conceptual role. The mapped literature commonly discusses portability, connectivity, real-time communication, feedback responsiveness, and cross-context accessibility as potential affordances of mobile applications for learning across time and place. Mobile applications are also discussed in the literature as part of the infrastructure associated with the organization and support of mobile learning [21], [32], [36]. These implications should therefore be interpreted as conceptual directions for future research.

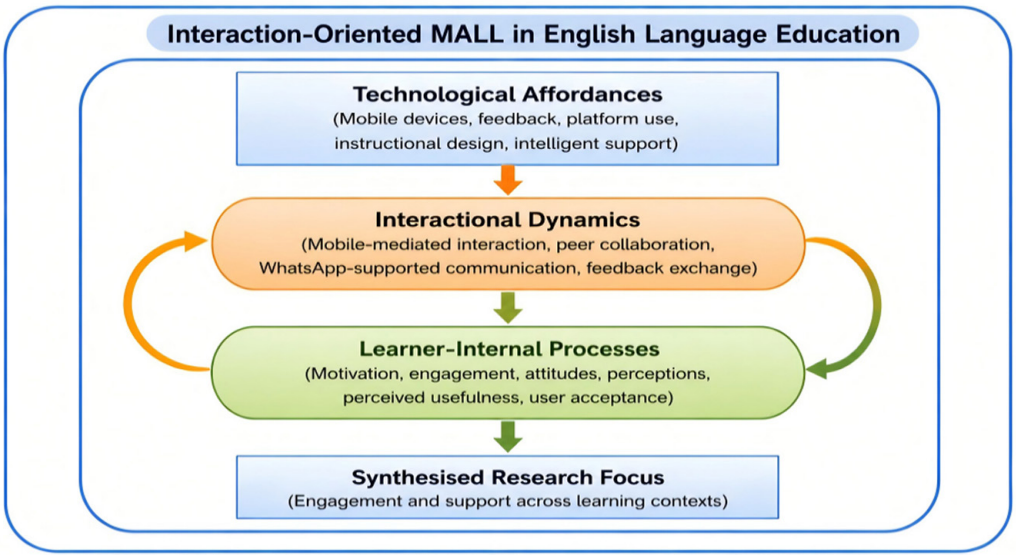


**Fig. 9.** Conceptual synthesis of interaction-oriented MALL patterns in English language education

### 4.2 Practical and research implications

These findings have several literature-informed implications for future research and practice related to mobile technologies in English language education. The mapped literature indicates increasing scholarly attention to instructional design, language-learning objectives, feedback, learner interaction, and teacher professional development in mobile learning contexts [9], [37], [38]. Rather than providing direct evidence of classroom effectiveness, this study identifies areas that warrant further empirical investigation. These include how feedback, task design, system responsiveness, and teacher expertise are discussed in relation to learner engagement and technological affordances [23], [39]. At a broader level, publication and thematic patterns point to the importance of contextual conditions beyond the classroom. Technological access, institutional support, and policy resources may influence how mobile language learning is studied and implemented across national and regional contexts [40], [41]. Future comparative research could examine underrepresented, developing, and resource-constrained contexts, particularly in relation to infrastructure, policy support, sustained technology use, and educational equity. These directions may also inform future research aligned with SDG 4.

### 4.3 Limitations and future research directions

Despite its contributions, this study has several limitations. The dataset was limited to English-language articles indexed in SSCI or SCI-EXPANDED. Therefore, relevant studies published in other languages or indexed in other databases may not have been fully captured. This restriction may have underrepresented research published in regional journals and non-English-speaking contexts and may have influenced the observed country-level contributions, thematic patterns, and research trends. This database and language restriction ensured data consistency but may not represent all forms of scholarly output. Bibliometric indicators are influenced by citation time-lag effects and may favour earlier publications. Keyword clustering also relies on threshold settings and analytical parameters, which can simplify complex conceptual relationships. Future research may integrate records from multiple databases, such as WOS and Scopus. It may also combine bibliometric analysis with systematic reviews or empirical studies to gain a more comprehensive understanding of emerging intelligent mobile learning practices. More work is needed on ethical governance, digital literacy, and the pedagogical integration of advanced mobile learning systems. Increasing research engagement in under-resourced regions would also help foster a more balanced and inclusive global research landscape.

## 5 CONCLUSION

In conclusion, this study mapped the development of research on mobile technologies in English language education from 2016 to 2025 through publication trends, citation performance, thematic clustering, and temporal analysis. The findings indicate that the field has evolved around four major thematic areas: learning outcomes and performance; technology acceptance and instructional design; mobile-mediated interaction and feedback; and speaking and pronunciation development. Over time, the literature has moved beyond largely application-oriented concerns toward stronger attention to adoption frameworks, learner engagement, and intelligent support systems,

particularly in higher education contexts. The study also reveals an uneven global distribution of research output, highlighting the need for more balanced and inclusive development in underrepresented and resource-constrained contexts. Based on these findings, the study proposes a conceptual framework for interaction-oriented MALL. The framework should be understood as a synthesis of bibliometric patterns rather than as a validated explanatory model. It organizes the mapped literature around technological affordances, learner-internal processes, and interactional dynamics, and highlights how recent studies have increasingly discussed interaction, engagement, and learner support in mobile language learning environments.

## 6 ETHICAL CONSIDERATIONS

This study used publicly available bibliographic records and did not involve human participants. Ethical approval and informed consent were therefore not required.

## 7 CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest to report regarding this study.

## 8 FUNDING STATEMENT

This study received no external funding.

## 9 AI USAGE DECLARATION

The authors used AI-assisted tools solely for language refinement, clarity improvement, and grammar correction. The authors carefully reviewed and revised all AI-assisted outputs and take full responsibility for the final manuscript.

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