INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES
HRMARS MANAGEMENT ACADEMIC RESEARCH SOCIETY EXPLORING INTELLECTUAL CAPITAL
www.hrmars.com
ISSN: 2222-6990

A Bibliometric Review of Vocabulary Learning via Mobile Assisted Language Learning

Qiu Chuane, Siti Shuhaida Shukor

To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v13-i1/16208 DOI:10.6007/IJARBSS/v13-i1/16208

Received: *04* November *2022,* ***Revised:*** *06* December *2022,* ***Accepted:*** *25* December *2022*

Published Online: *16* January 2023

In-Text Citation: (Chuane & Shukor, 2023)

To Cite this Article: Chuane, Q., & Shukor, S. S. (2023). A Bibliometric Review of Vocabulary Learning via Mobile Assisted Language Learning. *International Journal of Academic Research in Business and Social Sciences*, *13*(1), 513 – 532.

Vol. 13, No. 1, 2023, Pg. 513 – 532

http://hrmars.com/index.php/pages/detail/IJARBSS | **JOURNAL HOMEPAGE**

Full Terms & Conditions of access and use can be found at
http://hrmars.com/index.php/pages/detail/publication-ethics

INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES
HRMARS MANAGEMENT ACADEMIC RESEARCH SOCIETY EXPLORING INTELLECTUAL CAPITAL
www.hrmars.com
ISSN: 2222-6990

A Bibliometric Review of Vocabulary Learning via Mobile Assisted Language Learning

Qiu Chuane, Siti Shuhaida Shukor(corresponding author)
Universiti Pendidikan Sultan Idris (UPSI), Tanjong Malim, Malaysia.
Email: sshuhaida@fbk.upsi.edu.my

Abstract
In recent years, Mobile Assisted Language Learning (MALL) has emerged as a widespread phenomenon in education as well as in EFL/ESL teaching and learning context with its own set of foundations, techniques, and implications. Among the related studies, a continuous growth in the number of MALL vocabulary studies can be witnessed over the last few decades. To this end, the primary purpose of this study is to identify research hotspots and future trends in the available research literature on vocabulary learning using MALL from 2007 to 2022. A total of 229 articles on this topic were selected from the Scopus database and analysed using Vosviewer software. We used bibliometric methods to reveal document types and yearly distribution of the retrieved articles, the most productive countries and journals, the most used keywords, the most used words in title and abstract area, and the most cited publications and authors (citation & co-citation) in the studies over the 16-year period. Findings showed an increased number of studies from 2007 to 2022 have been published in this field but with a slight fluctuation in between 2012 and 2018. China (24 publications) took the top prominent lead among all countries, whilst the most productive journal in this area was Lecture Notes in Computer Science (11 publications) by Springer Publishing company. In terms of the most frequently used keywords, “Vocabulary Learning” (120 occurrence), “Mobile Assisted Language Learning” (114 occurrence) and “App” (40 occurrence) were the top three ranks, meanwhile “Effect” (62 occurrence), “System” (56 occurrence) and “Foreign Language” (46 occurrence) were the most used words in title and abstract field. Based on the citation and co-citation documents and authors network, the most frequently cited document was Chen & Chung (2008) with 271 citations, while Chen, C. M (citation) with 549 citations and Stockwell, G (co-citation) with 104 citations were the most influential authors. Consequently, this study displays the evolution of the literature and may serve as a guide for future research by comparing existing articles and indicating current research interest as well as future research trends on this topic.
Keywords: Bibliometric Review, Visualization Analysis, Vocabulary Learning, MALL, EFL, ESL

Introduction

A strong command of vocabulary is the foundation and core element of language learning. Expanding one’s vocabulary knowledge can be helpful to one’s language proficiency (Laufer & Ravenhorst-Kalovski, 2010; Nation, 2013; Yang et al., 2021). Nonetheless, developing

vocabulary in classroom context, whether inadvertently or through conscious attention and explicit teaching, is seen as a long-term process that has remained one of the most difficult strategies for most English as a Foreign Language (EFL) as well as English as a Second Language (ESL) learners (Webb & Nation 2017; Xodabande, Pourhassan & Valizadeh, 2022). Very often, this long process is associated with insufficient exposure due to time constraints. As a result, teachers and students alike have been on the lookout for viable alternatives to traditional classroom instruction. This implies that EFL/ESL vocabulary learning strategies must be tailored to specific areas of vocabulary knowledge as well as individual learners' needs and characteristics (Yang et al., 2021).

With the rise of "Internet +" education and mobile terminals, rapid technological advancements have brought new ideas and methods to education reform, among which Mobile Assisted Language Learning (MALL) has emerged as a widespread phenomenon in education as well as in EFL/ESL language pedagogy with its own groundings and ramifications (Zhang & Crompton, 2021). Advances in mobile technology have created new opportunities for EFL/ESL students as well to improve their knowledge of various language skills through MALL as it has grown and been embraced steadily and incrementally in education (Demouy & Kukulska-Hulme 2010; Shadiev et al., 2017; Khodabandelou et al., 2021; Pourhassan & Valizadeh, 2022). Among these language skills in EFL/ESL context, vocabulary learning is one of the most frequently investigated and explored skills in recent MALL studies (Darmi & Albion, 2014; Burston, 2015) due to the real-time, convenient, and contextual learning opportunities which MALL is able to supply to learners' vocabulary learning (Chinnery,2006).

In comparison with traditional classroom teaching and learning manners, the approach to learning via MALL is considered as learner-centered in the sense of personalized learning (Octavia et al., 2019). Learning content and schedules can be arranged by learners independently based on their own educational level and environment. Because of the pervasiveness of mobile devices, a group of EFL/ESL learners engaged in vocabulary study can actively involve in limitless learning opportunities as well as virtual spaces that autonomous learning can be promoted (Foomani & Hedayati, 2016). Ali et al (2019) reported EFL/ESL learners were able to carry out learning flexibly as they could perform ubiquitous learning which short period of spare time can be taken to do small bites of the learning materials and to control their own learning with more empowerment (Hulme & Shield, 2008). Additionally, MALL is deemed as conducive to maintain learners' interest, increase engagement, and motivation in learning for its interactive features (Khan & Islam, 2019). Generally, MALL has simplified access to English language education and provided abundant learning opportunities for learners (Li and Fan, 2022).

Mobile learning trend has brought about numerous MALL studies that have investigated its effects on diversified language learning outcomes (Burston, 2014) including studies aiming at target words, the number of words delivered, and the measurements (Lin & Lin, 2019). In addition, a steady increase in the number of conventional, systematic reviews and meta-analysis research examining language learning in MALL by reviewing studies conducted over the past decades based on different educational levels, EFL/ESL proficiency, gender, and different approaches (Burston, 2015; Sung et al., 2016; Persson & Nouri, 2018) in helping EFL/ESL students promote their learning performance and skills (Jeong & Ouk, 2022) can be viewed. These review articles include Derakhshan & Khodabakhshzadeh (2011), who

conducted an in-depth review of text-message vocabulary learning in CALL and MALL contexts, Ahmad, Armarego & Sudweeks (2013) reviewed articles on the feasibility of MALL for developing the vocabulary skills of non-English speaking migrants, Burston (2015) and Mahdi (2018) conducted a meta-analysis to examine the effects of mobile learning on vocabulary acquisition, Lin & Lin (2019); Yang et al (2021) did a systematic review on mobile-assisted ESL/EFL vocabulary learning and theoretical trends, and Regina & Devi (2022) reviewed on CALL and MALL studies developing vocabulary retention.

Previous MALL research has covered a wide range of topics, with the majority reporting on limited research elements. Numerous conventional reviews, systematic reviews, and meta-analyses do have shed some light on how MALL could offer plausible ways to improve learners' EFL/ESL vocabulary (Rajendran & Thirumangai, 2021), while bibiometric reviews on vocabulary learning via MALL in EFL/ESL context is still scanty to the researchers' best knowledge. With this in mind, the current bibliometric review seeks to fill this void by reviewing previous studies conducted to improve EFL/ESL learners' vocabulary in MALL settings from 2007 to 2022. To address research hotspots and directions in the field, bibliometric analyses based on the following research questions were conducted.

1.What are the document types and yearly distribution of the retrieved articles on vocabulary learning via MALL in EFL/ESL context in Scopus?

2.What are the major countries and journals publishing research on vocabulary learning via MALL in EFL/ESL context in Scopus?

3. What is the distribution of the most used keywords and words in title and abstract sections in research on vocabulary learning via MALL in EFL/ESL context in Scopus?

4. What are the most cited articles and who are the most-cited (citation and co-citation) authors in research on vocabulary learning via MALL in EFL/ESL context in Scopus?

Method

Data Collection

Scopus database was used in this study to retrieve the related publications because it has smart tools for tracking, analysing, and visualizing research output in various fields such as science, technology, and humanities (Agapiou & Lysandrou, 2015) and it is also the world's largest single abstract and indexing database, as well as a searchable citation and abstract source for literature searching (Tober 2011; Agapiou and Lysandrou 2015). On April 15, 2022, the keywords "mobile assisted language learning" OR "mall" OR "mobile app" OR "mobile learning" AND "efl" OR "esl" OR "language learning" OR "language teaching" OR "english vocabulary" were entered into the "topic" sections of Scopus database. In total, 642 publications were searched out with a time span setting to all years and language to English. Furthermore, to ensure that the analysed articles were closely related to vocabulary learning via MALL in EFL/ESL context, we manually screened the title and abstract to eliminate irrelevant ones using the inclusion and exclusion criteria (Chen et al., 2021) shown in Table 1 in the strict sense. As a result, 229 publications were retained for further review.

Table 1
Inclusion and exclusion criteria for data screening

Items	Inclusion criteria
I1	The study should focus on vocabulary development using MALL.
I2	The studies can take the form of research articles, review articles, conference papers, book chapters etc.
I3	The primary goal of the study was to improve vocabulary learning.
I4	The study should be reported in English.
Items	**Exclusion criteria**
E1	Publication without abstract.
E2	The main outcomes were measured factors other than EFL vocabulary learning achievement.
E3	English was not assessed as a foreign or a second language.
E4	Studies have not been conducted in the context of EFL or ESL education.

Data Analysis

Bibliometric analysis examines the most important literature in a specific field of study using bibliographic indicators (Martín et al., 2020). According to Chang et al (2015), bibliographical information includes keywords, abstracts, authors, references, citations. For this bibliometric analysis, a software called VOSviewer was utilized. VOSviewer software employs association force normalization technique, VOS mapping technique and clustering technique (Eck & Waltman, 2014). Therefore, to obtain studies related to vocabulary learning via MALL in EFL/ESL context over the last 16 years comprehensively, the programs Excel 2019 and VOSviewer v1.6.18 vision software were used for data analysis purpose.

Following the acquisition of the 642 consolidated documents, the collaboration indicators were obtained using Excel 2019, and a process of standardization of author names and keywords was initiated by building thesauri in txt files (Sofyan & Abdullah, 2022). Description analysis was then applied to list the most predominant countries, journals, keywords, documents and authors. After that, VOSviewer software was used to obtain the visualization map and reveal the network of the most commonly used keywords, words in title and abstracts fields, citation analyses, and co-citation analyses in the studies for the bibliometric analysis in this study. Thematic analysis was performed on network clusters, which were represented by various colors and consisted of a group of nodes or items that were closely associated to one another.

Findings

1. What are the document types and yearly distribution of the retrieved articles on vocabulary learning via MALL in EFL/ESL context in Scopus?

Document Types

Articles retrieved from Scopus database can be classified according to document types including information about the publication's origin, such as journal articles, conference papers, and book chapters (Ahmi & Mohamad, 2019). Figure 1 depicts the document types used in vocabulary learning via MALL in EFL/ESL context over the last 16 years. Following filtering, a total of 229 documents were obtained comprising of 137 articles, 86 conference

papers, four review articles, and two book chapters. The majority of MALL research studies on vocabulary learning are original research articles, which represent approximately 60 percent of total publications. Meanwhile, the number of conference proceedings publications ranks the second, accounting for 37 percent of all publications. Other types of publications are conspicuously absent, particularly book chapters (n = 2, 1 percent) and reviews (n = 4, 2 percent) (see Figure 1).

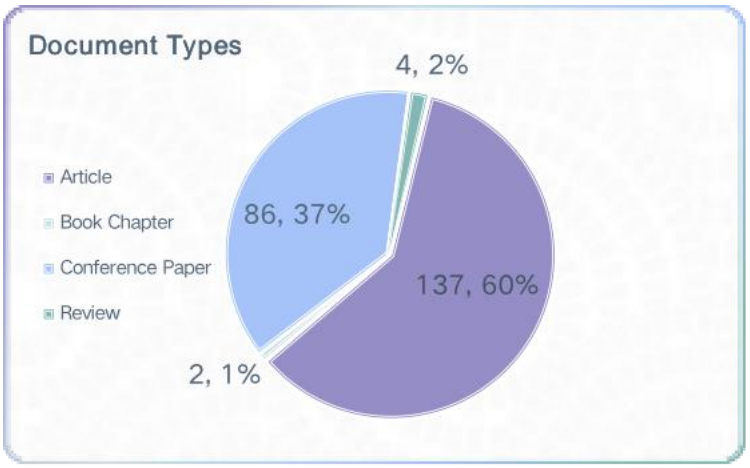

Figure 1. Document type of retrieved document

Yearly Distribution

Scholars can track the pattern and visibility of research by analysing the year of publication of the documents (Ahmi & Mohamad, 2019). The distribution of research publications on vocabulary learning via MALL in EFL/ESL context over the last 16 years is presented in Figure 2. It can be seen that a trend of slight growth in the number of publications from 2007-2018, but from 2019 to 2022, it shows an exponential upward movement. With a slight dip in 2018 (n = 16) and 2020 (n = 29), the number of articles had been steadily increasing overall, with the lowest publication in 2009 (n = 1) and a peak in 2021 (n = 40). It is worth noting that the number of articles for 2022 was only n = 7, because the data was retrieved until April 15, 2022 which was still in a early stage of the whole year of 2022. With the previous consistent pattern, it is predicted that the similar trend is likely to continue and become more extensive despite the annual number of article publications has been fluctuated slightly.

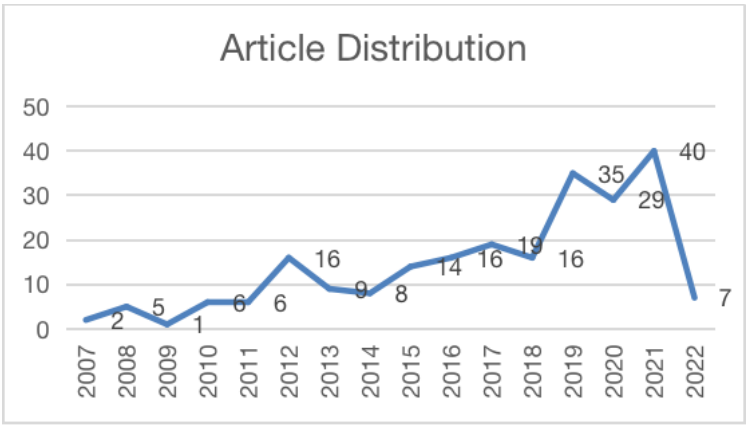

Figure 2. Yearly distribution graph of retrieved document

2. What are the major countries and journals publishing research on vocabulary learning via MALL in EFL/ESL context in Scopus?

Most Productive Countries

Figure 3 summarizes the top 10 rankings of countries where the studies were conducted for the last 16 years related to vocabulary learning via MALL in EFL/ESL context from 2005-2022. The results showed that the most popular country in research related to vocabulary learning via MALL in EFL/ESL context was China with a total of 24 articles discussing it, followed by Japan and Malaysia who shared similar rank with 18 publications in the second place, Iran with 14 publication ranked in the third place, whilst Indonesia, Turkey and the United States with 11 publications ranked in the fourth place. Meanwhile, the fifth place was shared between India, Saudi Arabia and Thailand with 7 publications respectively. In total, the top ten productive countries have contributed 128 documents, accounting for 55.89 percent of the total number of 229 documents, while articles from the rest of the countries have contributed 44.11 percent of the total number.

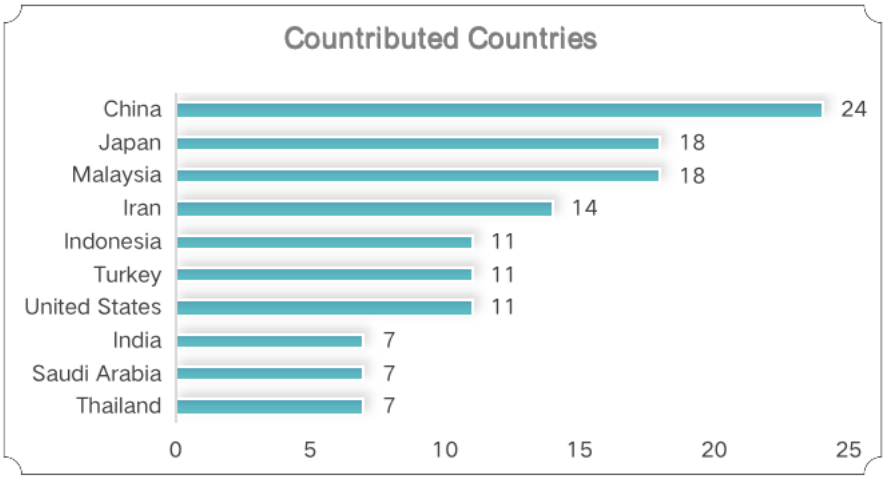

Figure 3. Contributed countries of retrieved document

Most Productive Journals

It can be seen from Table 2 for the top ten most productive journals. Represented by Scimago's Quartile, the top ten productive journals showed a relatively high quality. Six Q1 journals occupied 70 percent of all sections with Scimago Journal Rank ranges from 0.23-1.84, one Q2 (SJR = 0.41) journal accounting for 10 percent and one Q3 (SJR = 0.42) journal accounting for another 10 percent of the sections. Interestingly, the SJR of the Q2 (Lecture Notes in Computer Science, SJR = 0.41) and Q3 (International Journal of Interactive Mobile Technologies, SJR = 0.42) journals also represented high quality in terms of the SJR like Q1 journal such as CALL-EJ (SJR = 0.37). It is worth noting that the Acm International Conference Proceeding Series showed zero SJR as it is the conference proceedings. Inferentially, the top ten journals are all highly regarded.

The 229 relevant papers were published in 149 different journals. However, only 32 of these journals representing 21.47 percent had more than one article, and the top ten prominent ones, as shown in Table 2, contributed more than 24.01 percent of the total number of articles. The list was topped by Lecture Notes in Computer Science, which had 11 publications and was far ahead in terms of the number of articles published. It is the only journal in this

field that has published more than ten articles in the last 16 years. Other prolific publication sources was CALL-EJ (7 articles) with the second highest whilst the tenth rank went to Calico (3 articles).

In terms of citation, Journal of Computer Assisted Learning received the most number with 389 citations, followed by Recall with 140 citations. These are the only two journals that have citations over 100 times. As for the H-index, Lecture Notes in Computer Science with H-index of 415 and Acm International Conference Proceeding Series with H-index of 128 ranked the first and the second of the list. Surprisingly, journals that received high citations was found to not always get a high H-index.

Table 2
Top ten productive journals

No.	Source	D	C	TLS	H	SJR	Q
1	Lecture Notes in Computer Science	11	62	146	415	0.41	2
2	CALL-EJ	7	41	317	8	0.37	1
3	Acm International Conference Proceeding Series	6	14	19	128	0.23	0
4	International Journal of Mobile Learning and Organisation	6	33	491	26	0.88	1
5	Journal of Computer Assisted Learning	6	389	174	98	1.49	1
6	International Journal of Interactive Mobile Technologies	5	15	136	23	0.42	3
7	Journal of Educational Computing Research	5	61	381	64	1.28	1
8	Recall	5	140	482	57	1.34	1
9	Computer Assisted Language Learning	4	97	396	54	1.84	1
10	Calico Journal	3	33	72	41	0.59	1

*D: Document, C: Citation, TLS: Total Link Strength, H: H-index, SJR: Scimago Journal Rank, Q: Scimago's Quartile

3.What is the distribution of the most used keywords and words in title and abstract sections in research on vocabulary learning via MALL in EFL/ESL context in Scopus?

The Most used Keywords

Keywords and co-occurrence analysis using VOSviewer were applied to address the third research question. Keywords are the essence and focal point of a paper's main information. The keyword analysis will accurately reflect the paper's research direction, hotspots, and trends (Yuan & Liu, 2017). Each node in the keywords mapping symbolizes a keyword, when two keywords appear in the same article, they co-occur, implying a connection between the two topics, and the size indicates how frequently the terms have been used (Alloush et al., 2022). The co-occurrence of nodes is represented by links between them. The closer they are clustered, the more popular the topic, and the more important the position it holds in the network structure (Li & Chen, 2016).

Co-occurrence and keywords network analysis with a minimum of five occurrences, 48 items meet the threshold. It revealed six clusters representing six primary research topics being

explored in this area (see Figure 4). Cluster one (red nodes, 11 items): augment reality, computer assisted language learning, learning achievement, learning materials, learning performance, learning systems, motivation and vocabulary learning. Topic under this cluster focuses on students' vocabulary achievement, performance and affective domain such as motivation through AR or CALL or something alike. Cluster two (green node, nine items): the main items are app, experimental groups, foreign language, mobile computing, students, surveys. This branch regards checking students' vocabulary learning by surveys or experiments. Cluster three (dark blue nodes, nine items), this cluster mostly talks about students' vocabulary teaching and learning via different kinds of games because the main items are gamification, mobile games, mobile technology. Cluster four (yellow nodes, 8 items) stresses on vocabulary learning content, cluster five (purple nodes, nine items) pivots on vocabulary learning through e-learning while cluster six (light blue nodes, 4 items) emphasizes on vocabulary via mobile devices.

The frequently used keywords in vocabulary learning via MALL in EFL/ESL context studies are shown in Table 3. Vocabulary learning has been the most popular keyword (120 occurrence), followed by mobile assisted language learning (114 occurrence), app (40 occurrence), gamification (23 occurrence), EFL (19 occurrence), computer assisted language learning (15 occurrence), augmented reality (11 occurrence), language learning (11 occurrence), mobile phone (9 occurrence), and E-learning (8 occurrence). These are the top ten most frequently used keywords in this research field. The widely used and impressive keywords indicate that the research themes on these ten keywords are the popular trend in this area.

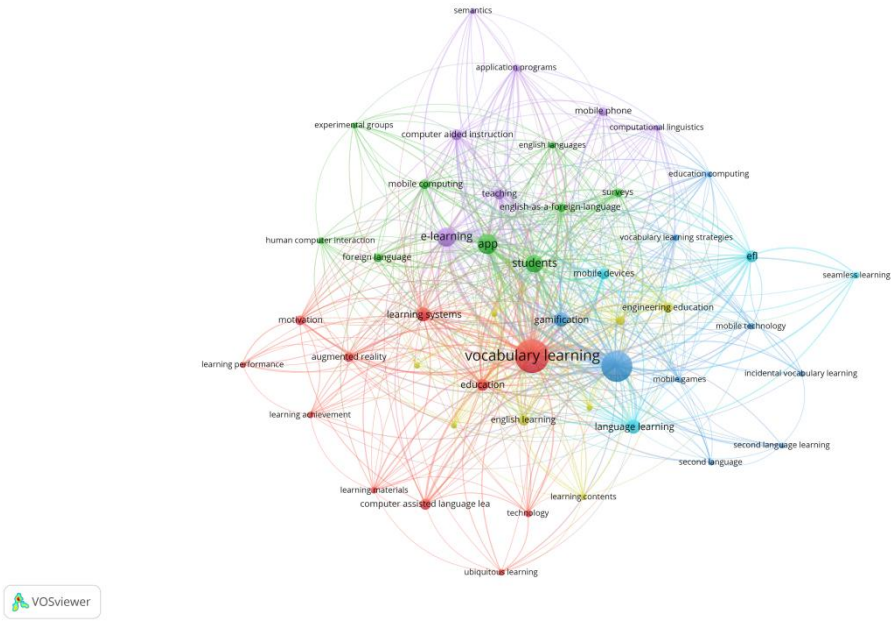

Figure 4. The network visualization of keywords co-occurrence

Table 3
Top ten most frequently used keywords & words used in title and abstract

No.	Keywords	F	TLS	No.	Words	F	RS
1	Vocabulary Learning	120	157	1	Effect	62	0.3583
2	Mobile Assisted Language Learning	114	151	2	System	56	1.3032
3	App	40	57	3	Foreign Language	46	0.4442
4	Gamification	23	38	4	Environment	43	1.059
5	EFL	19	40	5	Activity	42	0.635
6	Computer Assisted Language Learning	15	31	6	Experiment	38	0.3044
7	Augmented Reality	11	13	7	Test	36	1.0314
8	Language Learning	11	20	8	Control Group	35	1.0642
9	Mobile Phone	9	13	9	Experimental Group	34	1.2129
10	E-learning	8	14	10	Questionnaire	33	0.7018

*F: Frequency, TLS: Total Link Strength, RS: Relevance Score

The most used words in the title and abstract sections

A closer look at the layout of a title and abstract-based term co-occurrence network showing in Figure 5. A binary counting method was used, with each phrase having a minimum of ten occurrences, 72 items meet the threshold. According to the data, the VOSviewer generates three clusters. Cluster one contains 30 items with the main items being activity, advantage, challenge, child, concept, content, English learning, environment, feature, implementation, information, integration, interest, learning process, meaning, new vocabulary, opportunity, platform, problem, smart phone, system, teaching, and usability. Cluster two consists of 23 items with the core items of attitude, control group, difference, EFL, EFL learner, experimental group, foreign language, interview, outcome, perception, positive attitude, post test, questionnaire, retention, test, university, as well as vocabulary knowledge. Meanwhile, Cluster three comprises of 17 items with the main items of augment reality, benefit, effect, English word, experiment, experimental result, instruction, mobile, mobile assisted language learning, mobile phone, pretest, significant difference. Several terms of the same size, system, test, and effect, serve as the core node of the entire network in this study.

Besides, the figure of overlay reflected the temporal prevalence of keywords depending on their average time of appearance tracking the progression of the most critical topics (purple nodes around 2016, yellow nodes around 2019) (see Figure 7). The earlier the word appeared, the deeper the purple node. The later the word emerged, the brighter the yellow node. It is to be expected that items related to system, effect, test and MOOC stand out the most used words in four 5-year periods as shown in the figure, the most trending keywords are “Effect” (62 occurrences), “System” (56 occurrences), “Foreign Language” (46 occurrences), “Environment” (43 occurrences), “Activity” (42 occurrences), “Experiment” (38 occurrences), “Test” (36 occurrences), “Control Group” (35 occurrences), “Experimental Group” (34 occurrences), “Questionnaire” (33 occurrences). It indicates that studies in this area focus on investigating the effectiveness of the vocabulary learning via MALL in EFL/ESL context

generally using quasi-experiment containing the experimental group and the control group (see Table 3).

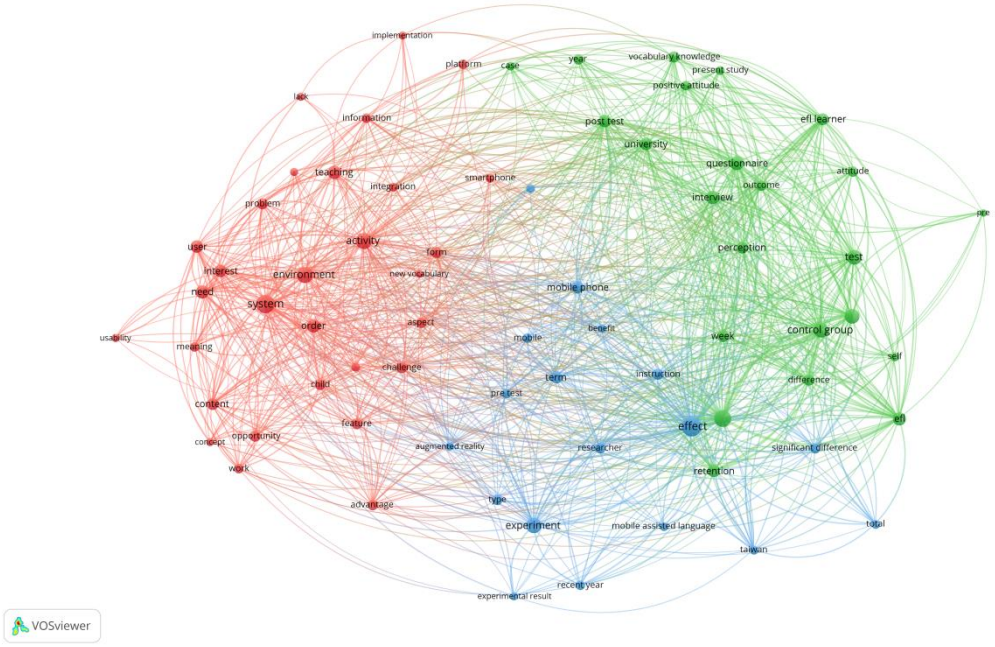

Figure 5. The network visualization of words co-occurrence in title and abstract field

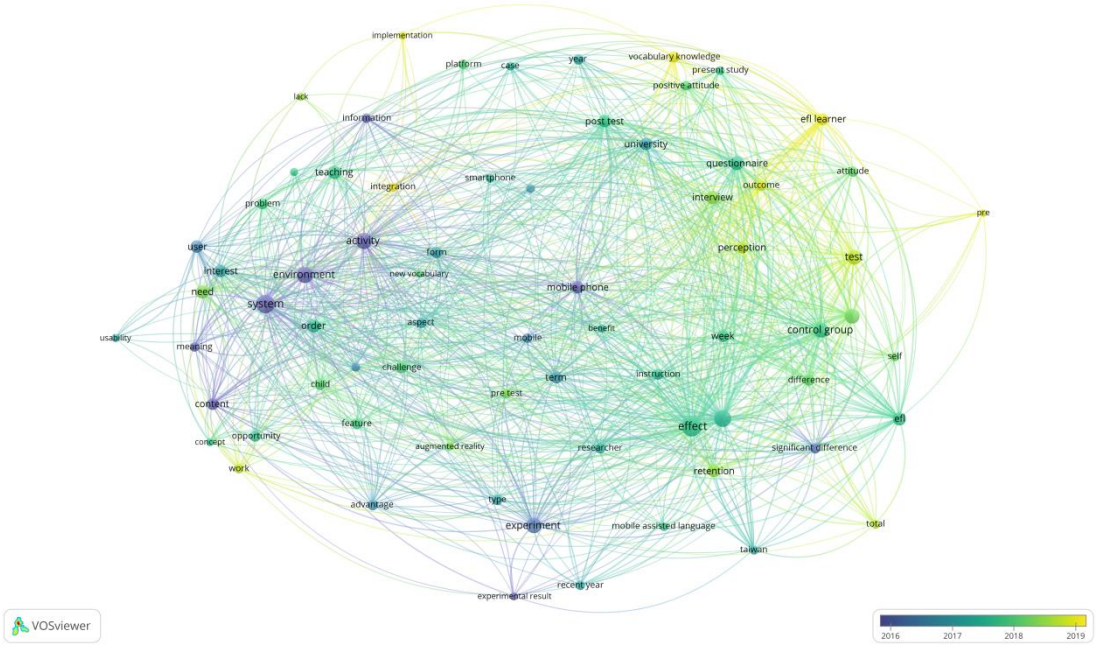

Figure 6. Overlay map of network visualization of words co-occurrence in title and abstract field

4.What are the most cited articles and who are the most cited (citation and co-citation) authors in research on vocabulary learning via MALL in EFL/ESL context in Scopus?

The most-cited articles

Based on the 229 documents, citation analysis was carried out to address the most predominant papers. 78 documents met the threshold with a minimum of 5 citations (see Figure 7). The analysis is predicated on the notion that the more citations a paper receives, the greater its influence in the research field (Zhao & Strotmann, 2008). Table 4 displays the top ten papers in terms of citations. They were all published in Q1 journal except Başoğlu & Akdemir (2010) published in Turkish Online Journal of Educational Technology which the status of this journal has been inactive since 2017. Table 4 indicates that the paper Chen & Chung (2008) publish in Computer & Education journal entitled "Personalized mobile English vocabulary learning system based on item response theory and learning memory cycle" is the most cited article in this field with a citation of 271. Based on Item Response Theory and learning memory cycle, this paper introduces a personalized mobile English vocabulary learning system. Individualization, ability, and memory cycle are employed to recommend appropriate English vocabulary learning approach to students. According to the findings, this system effectively applied efficient and adaptable vocabulary learning and endorsed learning performance. In combined capacity, the top ten papers listed in Table 4 received 2241 citations, accounting for 85.79 percent of the total 2612 citations for published documents. 50 percent of the paper obtained a citation more than 100 times, they are Chen & Chung (2008) with 271 citations, Lu (2008) with 216 citations, Chen & Li (2010) with 180 citations, Başoğlu & Akdemir (2010) with 124 citations, and Wong & Looi (2010) with 113 citations. Meanwhile, another 50 percent of articles only had citations of lower than 100 times, namely Wu (2015) with 81, Sandberg et al. (2014) with 76, Song & Fox (2008) with 74, Hsu et al. (2013) with 73, Lin & Lin (2019) with 46. It is notable that majority of the articles with high citation are concentrated on year from 2008-2015, that is because it takes a while for an article to acquire a massive number of citations, with some publications receiving none in the first one to two years before rising noticeably (Aksnes, 2003; Tahamtan et al., 2016; Aksnes et al., 2019).

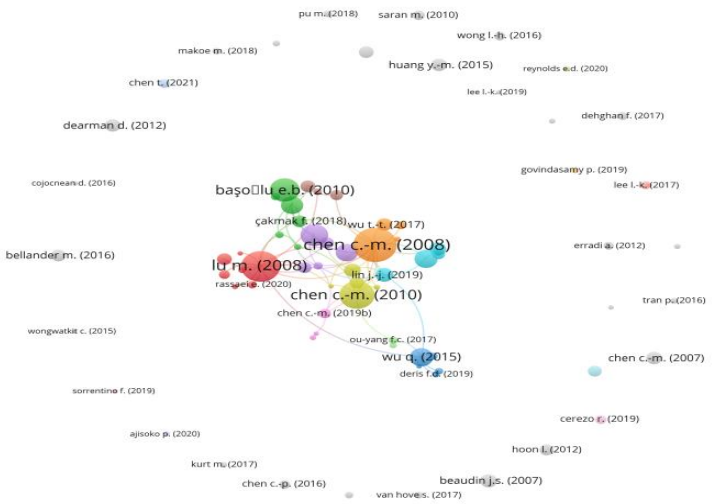

Figure 7. The network visualization of the most cited documents

Table 4
Top ten most cited documents

No.	Year	Author	Article	Journal	Q	TC	TLS
1	2008	Chen, C. M., & Chung, C. J.	Personalized mobile English vocabulary learning system based on item response theory and learning memory cycle	Computer & Education	Q1	271	40
2	2008	Lu M.	Effectiveness of vocabulary learning via mobile phone	Journal of computer assisted learning	Q1	216	58
3	2010	Chen, C. M., & Li, Y. L.	Personalised context-aware ubiquitous learning system for supporting effective English vocabulary learning	Interactive Learning Environments	Q1	180	42
4	2010	Başoğlu E.B. & Akdemir O.	A comparison of undergraduate students' English vocabulary learning: Using mobile phones and flash cards	Turkish Online Journal of Educational Technology	0	124	39
5	2010	Wong L.H. & Looi C.-K.	Vocabulary learning by mobile-assisted authentic content creation and social meaning-making: Two case studies	Journal of Computer Assisted Learning	Q1	113	33
6	2015	Wu Q.	Designing a smartphone app to teach English (L2) vocabulary	Computers and Education	Q1	81	98
7	2014	Sandberg J., Maris M. & Hoogendoorn P.	The added value of a gaming context and intelligent adaptation for a mobile learning application for vocabulary learning	Computers and Education	Q1	76	27
8	2008	Song Y. & Fox R.	Using PDA for undergraduate student incidental vocabulary testing	ReCALL	Q1	74	57
9	2013	Hsu C.K., Hwang G.-J., Chang Y.-T. & Chang C.-K.	Effects of video caption modes on english listening comprehension and vocabulary acquisition using handheld devices	Educational Technology and Society	Q1	73	81
10	2019	Lin J.J. & Lin H.	Mobile-assisted ESL/EFL vocabulary learning: a systematic review and meta-analysis	Computer Assisted Language Learning	Q1	46	187

*TC: Total Citation, TLS: Total Link Strength, H: H-index, Q: Scimago's Quartile

The Most Cited Authors

A total of 507 authors published 229 documents in this study. Figure 8 shows authors with the highest number of citations with a minimum limit of two citations, 72 items met the

threshold. The overlay figure illustrates the authors' citations' average time of appearance, purple nodes were around 2010, yellow nodes were around 2020 (see Figure 9). Chen C. M. was the author with the most citations (549 citations) over the past 16 years. His most representative article co-authored with Chung C. G. entitled "Personalized mobile English vocabulary learning system based on item response theory and learning memory cycle" published in the journal of Computers & Education in 2008 makes him the most highly cited author throughout the whole period. Following this Li Y. L. (215 citations) cooperated with Chen C. M. with the most cited article entitled "Personalised context-aware ubiquitous learning system for supporting effective English vocabulary learning" published in journal Interactive Learning Environments in 2010, and Wong L. H. (136 citations) with the most cited article "Vocabulary learning by mobile-assisted authentic content creation and social meaning-making: two case studies" published in Journal of computer assisted learning cooperated with CK Looi in 2010. Other authors are with a citation of below 100 times. They were Hwang G. J. (87 citations), Huang Y. M. (81 citations), Song Y. (80 citations), Wu T. T. (79 citations), Fox R. (76 citations), Chang C. K. (73 citations) and Chang Y. T. (73 citations) (see Table 5).

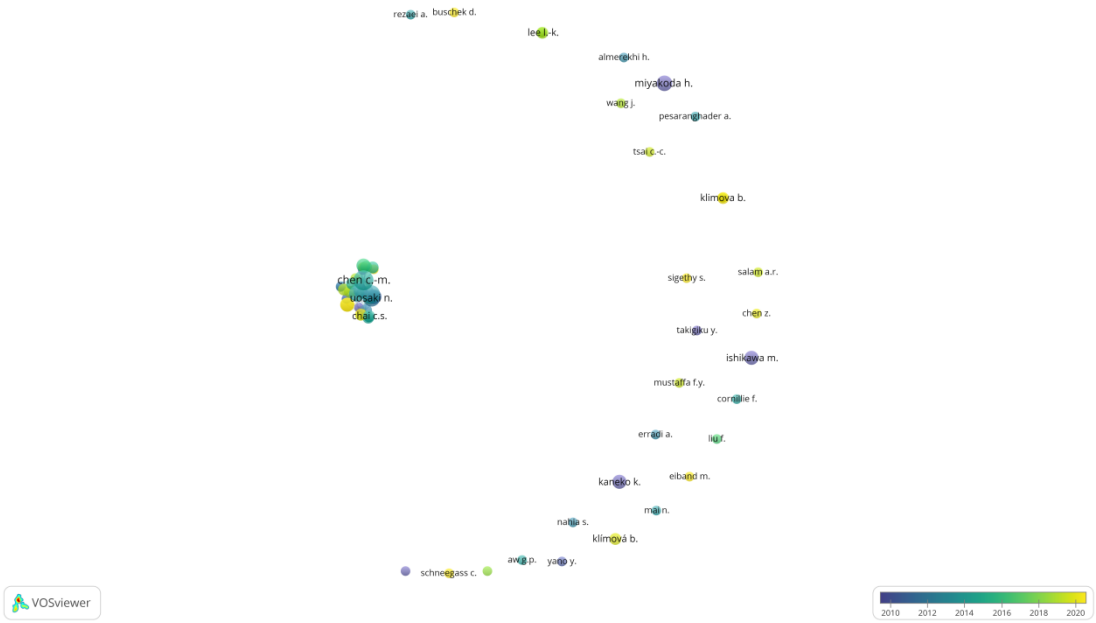

Figure 8. Overlay map of network visualization of the most cited authors

The Most Co-cited Authors

Figure 9 illustrates the author co-citation layout, which is based on 507 authors, 54 of whom met the minimum citation threshold of 20. In this network map, it showcases the most frequently co-cited authors. Taking into account the similarity of their co-citations, the author co-citation analysis groups authors into clusters on a network map (Small et al., 1985). From Table 5 which shows the top ten most co-cited authors, we can see that Stockwell, G. (104 co-citations) and Kukulska-HulmE, A. (102 co-citations) gained a co-citation of more than 100 times. Others are all below 100 times containing Nation, I.S.P. (80 co-citations), Hwang, G. J. (71 co-citations) Schmitt, N. (70 co-citations), Burston, J. (63 co-citations), Laufer, B. (62 co-citations), Mayer, R. E. (60 co-citations), Houser, C. (59 co-citations) and Thornton, P. (58 co-citations).

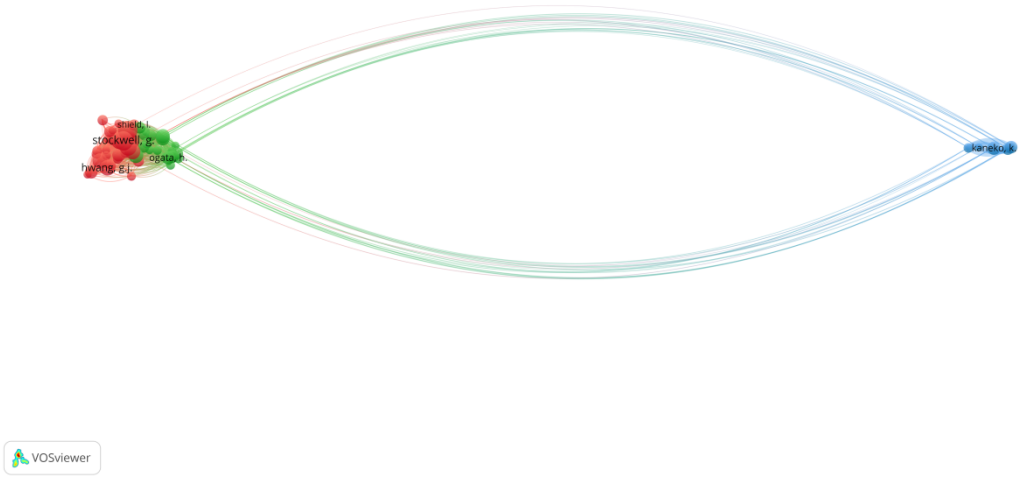

Figure 9. The network visualization of the most co-cited authors

Table 5
Top ten most cited & co-cited authors

Citation					**Co-citation**			
No	**Author**	**D**	**TC**	**TLS**	**No**	**Author**	**TC**	**TLS**
1	Chen C. M.	8	549	54	**1**	Stockwell, G.	104	1631
2	Li y. L.	2	215	12	**2**	Kukulska-HulmE, A.	102	1718
3	Wong L. H.	5	136	10	**3**	Nation, I. S. P.	80	1294
4	Hwang G. J.	3	87	7	**4**	Hwang, G. J.	71	1199
5	Huang Y. M.	3	81	4	**5**	Schmitt, N.	70	1079
6	Song Y.	3	80	25	**6**	Burston, J.	63	1047
7	Wu T. T.	3	79	3	**7**	Laufer, B.	62	1009
8	Fox R.	2	76	13	**8**	Mayer, R. E.	60	938
9	Chang C. K.	2	73	3	**9**	Houser, C.	59	1131
10	Chang Y. T.	2	73	3	**10**	Thornton, P.	58	1130

*D: Document, TC: Total Citation, TLS: Total Link Strength

Discussion

The purpose of this study was to present a bibliometric analysis of the literature on vocabulary learning via MALL in EFL/ESL context that was retrieved from the Scopus database between 2007 and 2022. This research is primarily comprised of articles and conference papers. According to research findings, over the last 16 years, research on vocabulary learning via MALL in EFL/ESL context has grown with a general upward trend, particularly in the latest five years. This growth process of vocabulary learning through MALL research is consistent with the international education development trend and the rapid development of technology

(Phan & Thanh-Thao, 2022). In terms of geographical distribution, scholars from 48 countries investigated a wide range of topics. China, Japan, and Malaysia leading with the first rank, have significantly more publications than other countries. Because these countries are in an ESL or EFL context, they may have paid more attention to the development of learners' English language abilities and thus contributed more to education studies in this area (Wang & Juan, 2022). Interestingly, not as prestigious as journals such as Computer Assisted Language Learning and Journal of Computer Assisted Learning, the journal Lecture Notes in Computer Science has also contributed the majority of the articles in this field. According to Zhang & Ling (2022), there are several possible explanations, including high-impact journals implementing more stringent peer-review procedures that require more time to publish an article. Second, some prestigious journals may have fewer issues and volumes. Findings suggest that in the past 16 years, students' vocabulary was fostered mostly by approaches of MALL, mobile apps, games, CALL, AR and E-learning. With the rapid evolution of technology, additional technologies such as AI, blockchain, and IoT devices, in addition to the popular approaches mentioned above, are suggested to devote more research efforts to future language classrooms (Tlili & Ahmed, 2022). According to the discovery of the top ten most cited articles, researchers have become more interested in students' learning outcomes and what can be improved by upgrading and monitoring mobile device systems that support learning activities. Additionally, researchers have also looking at a different perspective including user acceptance and usage of MALL. Therefore, the studies on "vocabulary learning system", "effectiveness of vocabulary learning", and "designing mobile phone app" are becoming more popular (Phan & Thanh-Thao, 2022). This study provides a list of relevant documents and authors who influenced vocabulary learning through MALL in EFL/ESL context. It can be deduced that from the bibliometically analysis of the cited and co-cited authors, new researchers such as Klimova B. and Zhang R. were found to constantly entering this field. In a long run, it is predicted that more researchers would focus on this topic in a long run for sustainable development.

Conclusion, Limitation and Recommendation

Using bibliometric analysis from the Scopus database, this study investigates the current hot research issues and emerging research topics of vocabulary learning via MALL in EFL/ESL context between 2005 and 2022. Over a 16-year period, we sought to identify document types and yearly distributions of retrieved literature, the most productive countries and journals, the most used keywords and words in title and abstract areas, and the most cited documents and authors (citation & co-citation). In conclusion, the findings of our study show that there has been an increase in global interest in vocabulary learning through MALL research over the last 16 years. This research area included a wide range of geographical and cultural contexts. In terms of contributing documents, countries with an ESL or EFL context, such as China, Japan, Malaysia, Iran, and Indonesia, have paid particular attention. The analysis of the co-occurrence of keywords and words in the title and abstract revealed varied research themes and interests including mobile learning apps, gamification, computer assisted language learning, augmented reality, e-learning, and vocabulary fostering through experiment. In the future, researchers and educators can conduct research on the most frequently occurring research hotspots and on the least frequently occurring topics to create some research innovations. Inevitably, the current study has some limitations such as in that searches were conducted in the Scopus database. Other multidisciplinary databases are suggested for future studies to confirm the research topics and trends. This bibliometric

analysis study is hoped to inform researchers and practitioners about potential research directions that researchers are interested to pursue while investigating this field of study.

References

Agapiou, A., & Lysandrou, V. (2015). Remote sensing archaeology: Tracking and mapping evolution in European scientific literature from 1999 to 2015. *Journal of Archaeological Science: Reports*, 4, 192-200.

Ahmad, K. S., Armarego, J., & Sudweeks, F. (2013, November). Literature review on the feasibility of mobile-assisted language learning (MALL) in developing vocabulary skills among non-English speaking migrant and refugee women. In 2013 International Conference on Research and Innovation in Information Systems (ICRIIS) (pp. 336-341). IEEE.

Ahmi, A., & Mohamad, R. (2019). Bibliometric Analysis of Global Scientific Literature on Web Accessibility. *International Journal of Recent Technology and Engineering (IJRTE)*, 20(1), 250–258. https://doi.org/10.1186/s12889-020- 09368-z

Alloush, T. K., Mansour, O., Alloush, A. T., Roushdy, T., Hamid, E., El-Shamy, M., & Shokri, H. M. (2022). Rhino-orbito-cerebral mucormycosis during the COVID-19 third wave in 2021: an Egyptian preliminary report from a single tertiary hospital. *Neurological Sciences*, 43(2), 799-809.

Ali, M. M., Mahmood, M. A., Anwar, M. N., Khan, L. A., & Hussain, A. (2019). Pakistani learners' perceptions regarding mobile assisted language learning in ESL classroom. *International Journal of English Linguistics*, 9(4), 386-398.

Basoglu, E. B., & Akdemir, O. (2010). A comparison of undergraduate students' English vocabulary learning: Using mobile phones and flash cards. Turkish Online Journal of Educational Technology-TOJET, 9(3), 1-7.

Burston, J. (2014). MALL: The pedagogical challenges. *Computer Assisted Language Learning*, 27(4), 344-357.

Burston, J. (2015). Twenty years of MALL project implementation: A meta-analysis of learning outcomes. *ReCALL*, 27(1), 4-20.

Chang, Y. W., Huang, M. H., & Lin, C. W. (2015). Evolution of research subjects in library and information science based on keyword, bibliographical coupling, and co-citation analyses. *Scientometrics*, 105(3), 2071-2087.

Chen, C. M., & Chung, C. J. (2008). Personalized mobile English vocabulary learning system based on item response theory and learning memory cycle. *Computers & Education*, 51, 624-645.

Chen, T., Peng, L., Yin, X., Rong, J., Yang, J., & Cong, G. (2020). Analysis of user satisfaction with online education platforms in China during the COVID-19 pandemic. *Healthcare*, 3(8), 1-20.

Chen, T., Peng, L., Yang, J., & Cong, G. (2021). Analysis of user needs on downloading behavior of English vocabulary APPs based on data mining for online
comments. *Mathematics*, 9(12), 1341.

Darmi, R., & Albion, P. (2014). A Review of Integrating Mobile Phones for Language Learning. In 10th International Conference Mobile Learning 2014 (pp. 93-100). International Association for the Development of the Information Society.

Derakhshan, A., & Khodabakhshzadeh, H. (2011). Why CALL why not MALL: An in-depth review of text-message vocabulary learning. *Theory and Practice in Language Studies*, 1(9), 1150-1159.

Foomani, E. M., & Hedayati, M. (2016). A seamless learning design for mobile assisted language learning: An Iranian context. *English Language Teaching*, 9(5), 206-213.

Laufer, B., & Ravenhorst-Kalovski, G. C. (2010). Lexical threshold revisited: Lexical text coverage, learners' vocabulary size and reading comprehension. *Reading in a Foreign Language*, 22(1), 15-30.

Lin, J. J., & Lin, H. (2019). Mobile-assisted ESL/EFL vocabulary learning: A systematic review and meta-analysis. *Computer Assisted Language Learning*, 32(8), 878-919.

Lu, M. (2008). Effectiveness of vocabulary learning via mobile phone. *Journal of computer assisted learning*, 24(6), 515-525.

Hsu, C. K., Hwang, G. J., Chang, Y. T., & Chang, C. K. (2013). Effects of video caption modes on English listening comprehension and vocabulary acquisition using handheld devices. *Journal of Educational Technology & Society*, 16(1), 403-414.

Jeong, K. O. (2022). Facilitating sustainable self-directed learning experience with the use of mobile-assisted language learning. *Sustainability*, 14(5), 2894.

Khan, M. M., & Islam, M. (2019). Tertiary Level Students' attitude towards the use of Mobile Assisted Language Learning (MALL). *Bangladesh Army University of Engineering & Technology*, 2(1), 139-146.

Khodabandelou, R., Fathi, M., Amerian, M., & Fakhraie, M. R. (2021). A comprehensive analysis of the 21st century's research trends in English Mobile Learning: a bibliographic review of the literature. *The International Journal of Information and Learning Technology*. DOI: 10.1108/IJILT-07-2021-0099

Kukulska-Hulme, A., & Shield, L. (2008). An overview of mobile assisted language learning: From content delivery to supported collaboration and interaction. *ReCALL*, 20(3), 271-289.

Mahdi, H. S. (2018). Effectiveness of mobile devices on vocabulary learning: A meta-analysis. *Journal of Educational Computing Research*, 56(1), 134-154.

Martin, M. C., Gonzalez, L. R., Marchena, J. A. M., Sanchiz, D. C. (2020). Teacher burnout: A bibliometric analysis of scientific production indexed on Scopus. *IJERI*, 2020 (14), 197–210.

Nation, P., & Meara, P. (2013). 3 Vocabulary. In An introduction to applied linguistics (pp. 44-62). Routledge.

Octavia, H., Widiati, U., & Irawati, E. (2019). Vocational Students' Perceptions of Mobile Assisted Language Learning (MALL) Materials. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, 4(10), 1347-1352.

Persson, V., & Nouri, J. (2018). A systematic review of second language learning with mobile technologies. *International Journal of Emerging Technologies in Learning*, 13(2).188-210.

Phan, T. T. T., Vu, C. T., Doan, P. T. T., Luong, D. H., Bui, T. P., Le, T. H., & Nguyen, D. H. (2022). Two decades of studies on learning management system in higher education: A bibliometric analysis with Scopus database 2000-2020. *Journal of University Teaching & Learning Practice*, 19(3), 09.

Rajendran, T., & Yunus, M. M. (2021). A systematic literature review on the use of mobile-assisted language Learning (MALL) for enhancing speaking skills among ESL and EFL learners. *International Journal of Academic Research in Progressive Education and Development*, 10(1), 586-609.

Regina, D., & Devi, V. A. (2022). A Review on Computer Assisted and Mobile Assisted Language Learning in Vocabulary Learning to Develop Retention of Learners in a Sustainable English Language Learning Environment. *ECS Transactions*, 107(1), 15859.

Sandberg, J., Maris, M., & Hoogendoorn, P. (2014). The added value of a gaming context and intelligent adaptation for a mobile learning application for vocabulary learning. *Computers & Education*, 76, 119-130.

Shadiev, R., Hwang, W. Y., & Huang, Y. M. (2017). Review of research on mobile language learning in authentic environments. *Computer Assisted Language Learning*, 30(3-4), 284-303.

Small, H., Sweeney, E., & Greenlee, E. (1985). Clustering the Science Citation Index using co-citations. II. Mapping science. *Scientometrics*, 8(5-6), 321-340

Sofyan, D., & Abdullah, K. H. (2022). College Sport Publication Trends Over 15 Decades: A Bibliometric Analysis. Khizanah Al-Hikmah: *Jurnal Ilmu Perpustakaan, Informasi, Dan Kearsipan*, 10(1), 69-82.

Song, Y., Fox, R. (2008).Using PDA for undergraduate student incidental vocabulary testing. *ReCALL*, 20(3), 290-314.

Sung, Y. T., Chang, K. E., & Liu, T. C. (2016). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers & Education*, 94, 252-275.

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

Van Eck, N.J., & Waltman, L. (2014). Visualizing bibliometric networks. In Y. Ding, R. Rousseau, & D. Wolfram (Eds.), Measuring scholarly impact: Methods and practice (pp. 285–320). Springer.

Webb, S., & Nation, P. (2017). How vocabulary is learned. Oxford University Press.

Wang, J., Abdullah, R., & Leong, L. M. (2022). Studies of Teaching and Learning English-Speaking Skills: A Review and Bibliometric Analysis. *Frontiers in Education*, 2022(7), 880990.

Wong, L. H., & Looi, C. K. (2010). Vocabulary learning by mobile-assisted authentic content creation and social meaning-making: two case studies. *Journal of computer assisted learning*, 26(5), 421-433.

Wu, Q. (2015). Designing a smartphone app to teach English (L2) vocabulary. *Computers & Education*, 85, 170-179.

Xodabande, I., Pourhassan, A. A., & Valizadeh, M. (2022). Self-directed learning of core vocabulary in English by EFL learners: comparing the outcomes from paper and mobile application flashcards. *Journal of Computers in Education*, 9(1), 93-111.

Yang, X., Kuo, L. J., Eslami, Z. R., & Moody, S. M. (2021). Theoretical trends of research on technology and L2 vocabulary learning: A systematic review. *Journal of Computers in Education*, 8(4), 465-483.

Zhao, D., & Strotmann, A. (2008). Evolution of research activities and intellectual influences in information science 1996–2005: Introducing author bibliographic-coupling analysis. *Journal of the American Society for Information Science and Technology*, 59(13), 2070-2086.

Zhang, J., & Crompton, H. (2021). Status and trends of mobile learning in English language acquisition: a systematic review of mobile learning from Chinese databases. *Asian Journal of Distance Education*, 16(1), 1-15.

Zhang, L., Carter Jr, R. A., Qian, X., Yang, S., Rujimora, J., & Wen, S. (2022). Academia's responses to crisis: A bibliometric analysis of literature on online learning in higher education during COVID-19. *British Journal of Educational Technology*, 53(3), 620-646.

Zhoumin, Y., & Huanhuan, L. (2017). Dynamic Visual Analysis of International Interlanguage Pragmatics Research. *Foreign Language Teaching Research*, 5, 456-463.