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A Bibliometric Analysis of Trending Mobile Teaching and Learning Research from the Social Sciences

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Abstract: With the development of computer and information technology, mobile teaching has enjoyed pride of place among teaching mediums in the past two decades. To visually explore the mobile learning hotspots and trends present in international journals, this study adopted two science mapping tools (CiteSpace and VOSviewer) to first detect and then visualise emerging trends (i.e., hotspots) in the mobile learning literature. A total of 528 mobile learning articles published between 2003 and 2021 that appeared in 21 international educational technology journals indexed in the SSCI database were retrieved for bibliometric analysis. The results show (1) there was a remarkable increase in academic output in this field starting in 2008 that topped out in 2021; (2) co-authorship with academics from diverse countries/regions and institutions was evident; (3) three trending foci in the literature include defining mobile learning, designing learning systems, and exploring mobile learning effectiveness; and (4) the high-frequency co-cited publications focus on the effectiveness of mobile devices via different research methods. This study provides scholars with an accessible summary of the current trends in mobile learning, identifies the active researchers in this field, and reports on which outlets are most relevant for research produced on this topic. In addition, the findings have direct implications for the education and private sectors. Mobile devices are not widely adopted in classroom settings and are often considered a learning tool more suited for out-of-class assignments or practice. Therefore, it is necessary for information technology educators to invest in actively initiating the integration of mobile technology into the classroom. Those in the technology industry should aim to develop mobile devices and relevant educational applications/software that can be utilised not only within the confines of the classroom but also to bridge in-class and out-of-class learning.

Keywords: mobile teaching; mobile learning; CiteSpace; VOSviewer; SSCI; bibliometric analysis

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1. Introduction

Technology, especially mobile technology, has played an essential role in students' learning process during the COVID-19 pandemic. According to technologists, mobile learning involves learning on a mobile device (e.g., tablet, mobile phone, laptop) [1]. Additionally, mobile learning is considered a continuation of e-learning. In learner-centred theory, it is believed that mobile technologies allow students to learn in a constantly changing and nondeterministic environment to maximise learning opportunities [2]. As part of school education, mobile learning has changed in several ways: (1) the way teaching content is presented; (2) how students learn; (3) the methods teachers use to teach; and (4) the way students interact with teachers [3]. Mobile learning has established itself as a common phenomenon in educational pedagogy that has received widespread attention from educators and researchers.

Mobile learning research originated at the end of the 20th century. Researchers have extensively studied this field over the past two decades, providing insights into theory and practice. After many researchers have studied mobile learning from various perspectives,

some researchers pointed out the need to review the literature in this field. One good example is Wu et al. [4], who conducted a meta-analysis of 164 mobile learning studies from 2003 to 2010. Their results showed that mobile learning effectiveness and system design are primary research areas, with system design having dominated the research trajectory. Besides meta-analysis, bibliometric analysis is also a common method to study this field's literature. For example, Khan and Gupta [5] conducted a bibliometric analysis of mobile learning research from a student-centred perspective. According to co-citation analysis of 722 articles, four clusters (concept, application in education, designing framework for model learning/acceptance, and emerging technologies) of hotspots were identified. In a similar vein, Goksu [6] analysed 5167 mobile learning articles published until September 2019. The study uncovered mobile learning research trends. They found the researchers coming from Taiwan, USA, Mainland China, and England were the most productive with Taiwan responsible for the lion's share of research produced. In addition, the single university producing the most research in this area was also in Taiwan. Lastly, keyword co-occurrence analysis showed mobile devices, higher education, mobile technologies, tablet, and smartphone as high frequency keywords in this field.

Due to its high functionality, CiteSpace has been the go-to software of bibliometric analysis conducted by Chinese scholars [7–9] but has been utilized less by mobile learning scholars outside Greater China (e.g., Khan and Gupta [5]; Goksu [6]). Zhang [10], as an example, focused on research topics and development trends of mobile learning published from 2010 to 2020 by using three software programs, namely UCINET, SPSS and CiteSpace. The results showed a steady rise in the number of relevant research papers as well as several highly cited and influential publications. The uncovered research themes included technical support, learning design, learning mode and practice. In addition to research published in Chinese journals conducted by Chinese scholars, Xu et al. [11] carried out an analysis of 2392 papers in the field of mobile learning retrieved from the Web of Science database from 1997 to 2017. That study showed mobile learning research has received extensive attention from researchers in various research fields around the world, involving three research hotspots, namely the impact of information technology development on mobile learning, the design of mobile learning systems, and context awareness for mobile learning. This study also brought to attention three relevant research frontiers: the application of emerging technologies, the smartphone-based model, and the effectiveness on students' learning.

While these studies were insightful, CiteSpace software has seldom been used by researchers outside Greater China to explore the field of mobile learning. A broad literature search uncovered only two researchers outside Greater China using this software. Khodabandelou et al. [12] conducted a comprehensive analysis of mobile learning in the domain of English learning in the 21st century and found research on English mobile learning is growing rapidly and steadily, especially studies on various device-based technologies and applications. Rawat and Sood [13] performed knowledge mapping of computer applications in education that found mobile learning has received increasing attention in applied information and communication technology in higher education, especially in engineering education. As exemplified by these two studies, CiteSpace software can detect and visualise trends/patterns in published literature [14].

The existing mobile learning bibliometric reviews have the following research limitations: (1) some of the latest reviews on mobile learning are limited to a single subject (i.e., English); (2) the data sources are extensive but may not be able to summarise the research published in competitive outlets; and (3) the time range of the literature analysed was limited, which cannot fully reflect the overall trend of the research hotspots in this field. Moreover, online learning during the COVID-19 pandemic made mobile learning a common practice, potentially leading to new developments. This study aimed to provide a detailed exploration of the past two decades of publications focusing on mobile learning appearing in the exclusive and competitive SSCI database. The study also aimed to summarise the most influential countries/regions, researchers, and publications. Having

access to this information allows for tracing of the origin of this field and to assist scholars in understanding its evolution and future trajectory.

The research questions that guided this study are:

(1) What are the mobile teaching and learning publishing trends?
(2) Who are the prolific authors in the field of mobile teaching and learning, and how strong are the researchers' collaborations?
(3) Which institutions have led to the development of mobile teaching and learning research and which institutions have had the most extensive collaborations?
(4) Which countries/regions have led to the development of mobile teaching and learning research and which countries/regions have had the most extensive collaborations?
(5) What are the mobile teaching and learning research hotspots and what future trends can be predicted?

2. Methodology

2.1. Data Source

At the beginning of 2022, SSCI-indexed journals containing the following keywords were extracted from the 2021 Journal Citation Report: "EDUCATION & EDUCATIONAL RESEARCH", "LEARN*", "TECH*", "COMPUT*", "Internet", "Distance", "TEACH*", "INSTRUCT*". From a total of 264 journal titles, removal of redundant journal titles resulted in 21 journals.

Title searches were conducted in the Web of Science Core Collection Database for each of these 21 targeted journals (TS = "mobile learning" OR "m-learning" OR "mlearning"). These searches resulted in 528 articles after the application of two inclusion criteria (see Table 1). The publications were: (1) highly relevant to mobile learning; and (2) were articles (e.g., not a book review). The full texts and complete bibliographic records for the 528 articles were retrieved.

Table 1. Article number retrieved from targeted journals.

Journals	*n*
Computers & Education	98
Educational Technology & Society	72
Education and Information Technologies	64
British Journal of Educational Technology	51
Journal of Computer-Assisted Learning	44
International Review of Research in Open and Distributed Learning	38
Educational Technology Research and Development	26
Australasian Journal of Educational Technology	26
Journal of Educational Computing Research	26
IEEE Transactions on Learning Technologies	25
Technology, Pedagogy and Education	11
Journal of Science Education and Technology	8
Distance Education	8
International Journal of Educational Technology in Higher Education	7
Journal of Computing in Higher Education	7
Learning Media and Technology	6
Internet and Higher Education	5
Research in Science & Technological Education	3
Journal of Research on Technology in Education	2
International Journal of Computer-Supported Collaborative Learning	1
International Journal of Technology and Design Education	0
Total	528

Note. *n* = article number.

2.2. Method

CiteSpace and VOSviewer are the visualisation tools that were used to conduct the bibliometric analysis. Although they share similarities, VOSviewer builds and visualises

the network based on cocitation. In contrast, CiteSpace, based on a cocitation network, offers clustering analysis, social network analysis, multidimensional scaling and other analytical methods. CiteSpace allows researchers to explore and analyze the evolution and trends of a targeted research frontier [15,16]. Therefore, this study combined these tools to gain a more comprehensive picture of the current state of mobile learning literature.

3. Results

The results are given in five parts in response to the research questions. First, descriptive bibliometric analysis via WOS reports on mobile learning research (e.g., time trends) was performed. Second, WOS and VOSviewer co-authorship was reported to identify high-yield mobile learning researchers' and their collaboration networks. The third and fourth parts further explained research hotspots and trend summaries on the knowledge mappings containing keywords and cited literature.

3.1. What Are the Mobile Teaching and Learning Publishing Trends?

An important indicator for measuring the development of a particular field is the change in the number of publications [17]. In general, the published mobile learning articles can be divided into three periods: (1) the quiet period (2003–2007), (2) the rapid rise period (2007–2010), and (3) the fluctuation period (2010–2021). Two important time points are also notable: 2006 and 2020 (see Figure 1). The number of publications in 2020 was the highest (n = 72) within the two decades and after the emergence of mobile learning research in 2003 the lowest number of publications was in 2006 (n = 0).

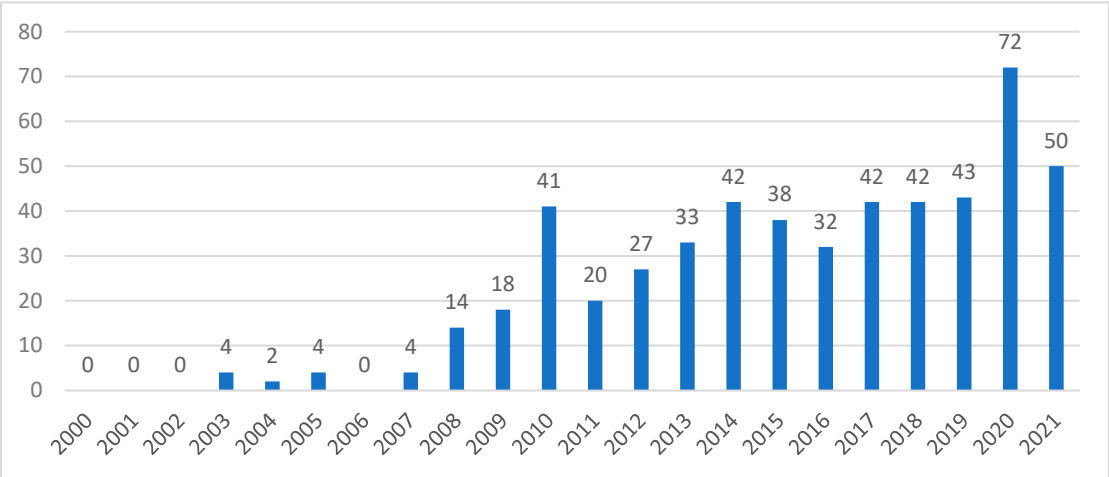

Figure 1. Number of articles by year.

3.2. Who Are the Prolific Authors in the Field of Mobile Teaching and Learning, and How Strong Are the Researchers' Collaborations?

Prolific authors are determined by their scholarly contributors calculated as the number of papers they have published in a particular research area [18]. The CiteSpace mapping analysis of prolific authors in the field of mobile learning is shown in Figure 2.

Table 2 reports the highest yielding researcher in the mobile learning field as Gwo-Jen Hwang. His publication number is nearly double that of the scholars ranked 2 and 3 and nearly thrice of scholars ranked 4 and 5. Gwo-Jen Hwang has been reported as tending to investigate mobile devices as teaching/learning tools in practice [4,19–21]. Gwo-Jen Hwang has stronger collaborations with a larger number of researchers than the other high-yield authors. This is likely due to the large number of publications he has produced—the more publications, the more collaboration.

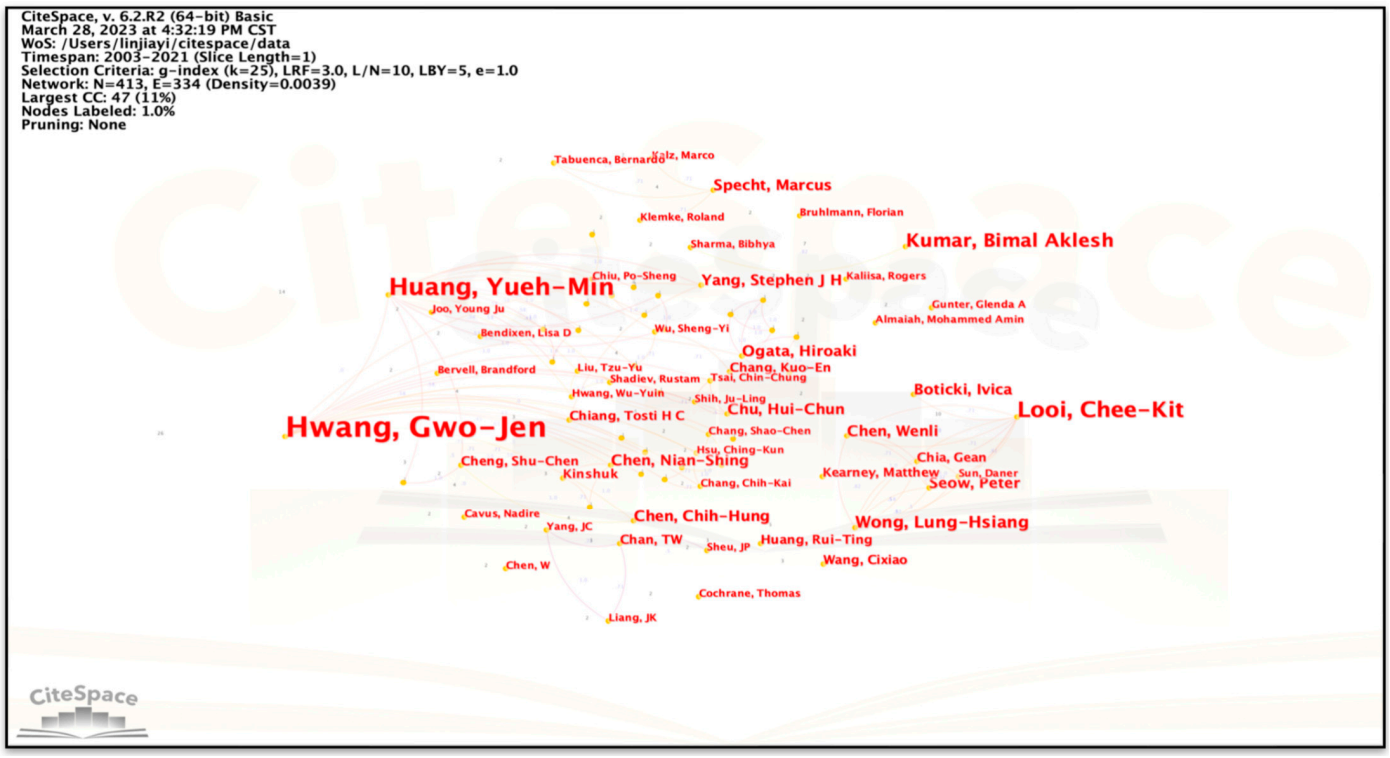

Figure 2. The knowledge mapping of most prolific authors in the field of mobile teaching and learning.

Table 2. Most prolific researchers in the field of mobile learning.

Rank	Researcher	*n*	% of 528 Articles
1	Gwo-Jen Hwang	29	5.49%
2	Yueh-Min Huang	16	3.03%
3	Chee-Kit Looi	15	2.84%
4	Wu-Yuin Huang	10	1.89%
5	Lung-Hsiang Wong	10	1.89%

Table 2 reports the second highest yielding researcher in the mobile learning field is Yueh-Min Huang. Yueh-Min Huang's research interests are in the effective use of mobile systems in various educational fields, such as language learning, science curricula, and nursing; his research also involves the design of a cognitive diffusion model in a mobile learning environment [4,22,23].

The remaining three researchers have focused their research on teachers and students in primary school and elementary school [24–26].

3.3. Which Institutions Have Led to the Development of Mobile Teaching and Learning Research and Which Institutions Have Had the Most Extensive Collaborations?

Institutions serve as major scientific research forces in one country or region. This section reports the number of publications produced by each institution to identify the regional distribution of mobile learning research and to explore the partnerships between each university (see Table 3). National Taiwan University of Science Technology and National Central University are both high-yield institutions. Universities in Taiwan took the top four spots. The other top-yield institution is in Singapore. However, Singapore was not found to be a prolific country or region for mobile learning (see Table 4). While the yield of publications per university in Singapore is high, the overall yield of publications cannot amass those of Taiwan, USA, and Mainland China. This is likely due to the large number of universities in these countries/regions.

Table 3. Most prolific institutions in the field of mobile teaching and learning.

Rank	Institution	*n*	%
1	National Taiwan University of Science and Technology	32	6.06%
2	National Central University	30	5.68%
3	National Cheng Kung University	21	3.98%
4	National Taiwan Normal University	20	3.79%
5	Nanyang Technological University	18	3.41%

Table 4. Most prolific countries/regions in the field of mobile teaching and learning.

No	Country/Region	*n*	Percent
1	Taiwan	129	24.43%
2	USA	82	15.53%
3	Mainland China	58	10.99%
4	England	37	7.01%
5	Australia	34	6.44%

Figure 3 shows the co-authorship network of the top 18 prolific institutions in the field of mobile learning. National Taiwan University of Science and Technology occupied the first place due to it possessing the most robust collaboration network (link strengths = 26). The collaboration strengths of National Central University, National Taiwan Normal University, National University of Tainan, and National Cheng Kung University are all approximately 16. Figure 4 shows that the co-authorship collaboration network of co-authors contains nine items and three clusters. The main contributors are three researchers, Gwo-Jen Hwang, Yueh-Min Huang, and Stephen J.H. Yang.

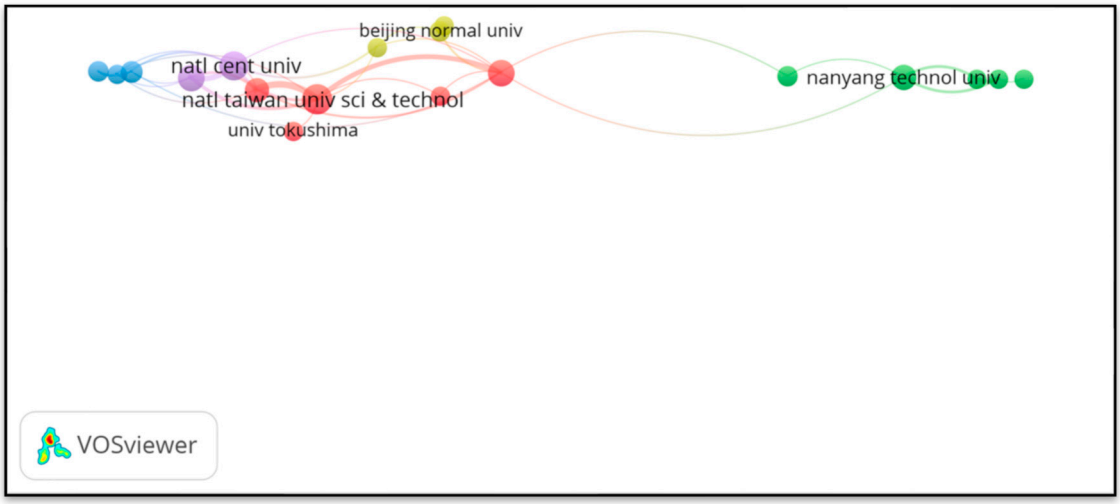

Figure 3. The knowledge mapping of co-authorship collaboration network among institutions.

3.4. Which Countries/Regions Have Led to Development of Mobile Teaching and Learning Research and Which Countries/Regions Have Had the Most Extensive Collaborations?

Table 4 lists the most prolific countries/regions in the field of mobile learning. Taiwan is at the top, possessing the highest number of published papers (*n* = 129, 24.43%). The USA has also made an outstanding contribution to mobile learning, ranking them second. Likewise, Mainland China has also made its mark with a third-place ranking.

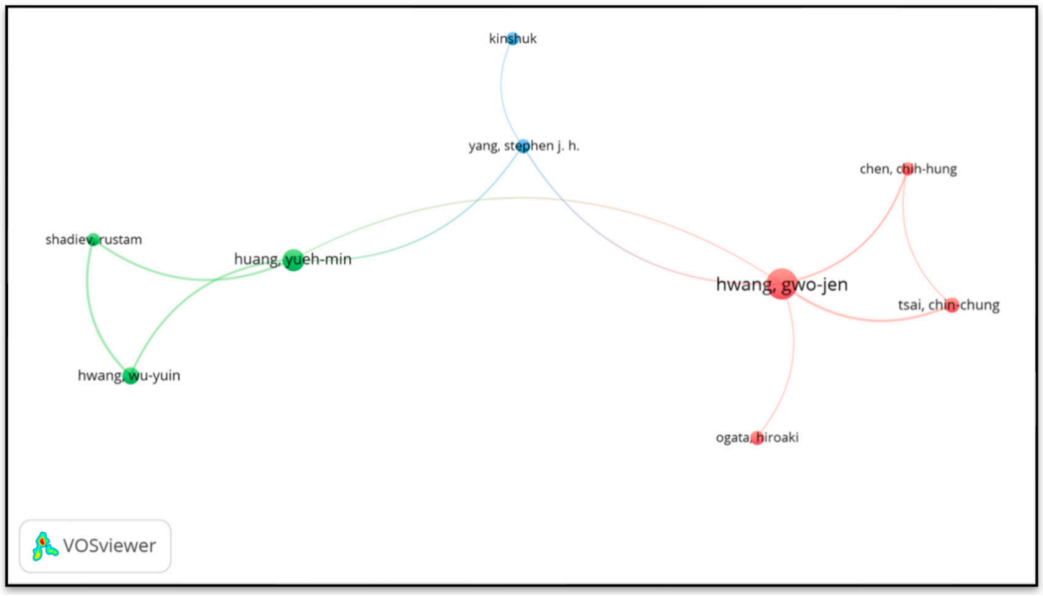

Figure 4. The knowledge mapping of co-authorship collaboration network among mobile teaching and learning scholars.

The VOSviewer software analysis clearly demonstrates the co-authorship of the mobile learning researchers. The link connecting two circles represents co-authorship, while the same circle colour represents one cluster. The size of the circle implies the percentage of total publications analysed. Figure 5 shows that the top 27 countries/regions can be clustered into 6 groups. USA authors ($n_{publications}$ = 82; link strength = 41) possess a strong collaborative relationship with researchers from 13 other countries/regions. Scholars from Taiwan also possess a strong collaborative relationship with researchers from 27 other countries/regions through many co-authored publications ($n_{publications}$ = 129; link strength = 35).

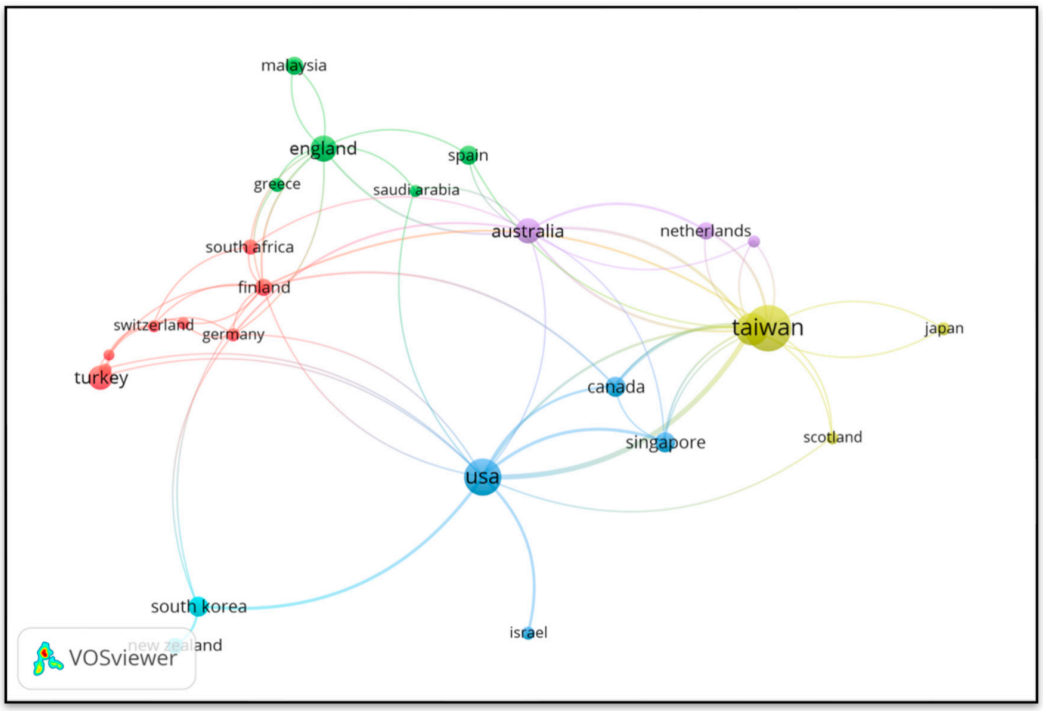

Figure 5. Co-authorship among most prolific countries/regions in the field of mobile teaching and learning.

3.5. What Are the Mobile Teaching and Learning Research Hotspots and What Future Trends Can Be Predicted?

3.5.1. Keyword Co-Occurrence Analysis

Examining high-frequency and high-centrality keywords can give researchers an idea about the developmental trends and research hotspots in the mobile learning field. Centrality refers to the degree of importance of a node (e.g., a keyword, a publication, or an author) and year refers to the year in which the keyword first appeared. After extraction of the keywords from the publications, the mapping of their co-occurrence was computed and is illustrated in Figure 6. Table 5 provides the high-frequency keywords (i.e., those occurring 15 times or more). Manual analysis of all the keywords allowed for them to be grouped into three main themes: (1) the design of mobile learning system, (2) the acceptance of technology, and (3) students' performance after using a unique teaching strategy.

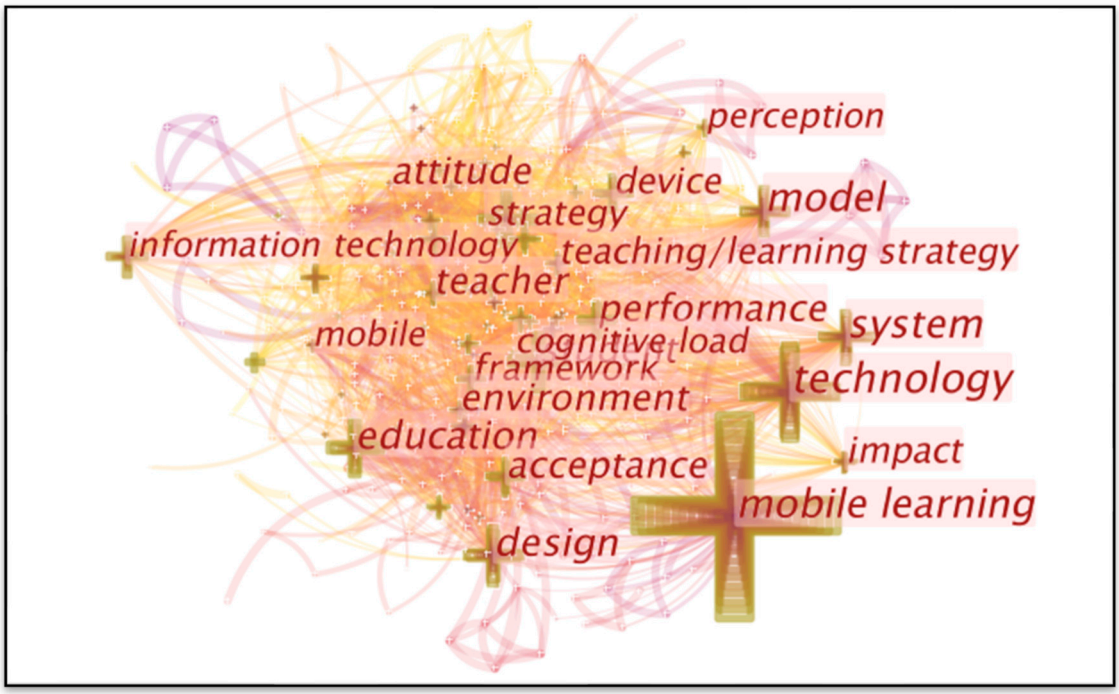

Figure 6. The knowledge mapping of the keywords co-occurrence.

3.5.2. Keyword Clusters

The VOSviewer software timeline view of the keyword network showed 411 keyword nodes and 2303 links between them. We used the keywords and log-likelihood ratio (LLR) weighing algorithm to identify 11 keyword clusters. Each cluster was labelled with an appropriate research cluster theme name based on the most frequently occurring keywords found within it. CiteSpace software offers two indicators: modularity (Q) and silhouette (S) [27]. Modularity refers to a measure of how well the nodes in the network are organised into cluster communities based on their co-occurrence pattern while the silhouette value is a measure of the consistency and the quality of the cluster. The silhouette values ranged from −1 to 1, with higher values indicating better clustering. This study shows a precise clustering boundary and clustering scale. Q is equal to 0.3836 (>0.3), and S is equal to 0.7392 (>0.5). Table 6 provides relevant information on the keyword cluster analysis.

Table 5. High-frequency keywords.

Count	Centrality	Year	Keywords
300	0.30	2005	Mobile learning
89	0.20	2007	Technology
64	0.06	2009	Student
53	0.11	2008	Education
51	0.09	2008	Design
51	0.14	2010	System
46	0.03	2010	Higher education
36	0.06	2010	Performance
35	0.06	2010	Acceptance
35	0.12	2010	Model
29	0.05	2011	Device
28	0.03	2009	Adoption
26	0.02	2012	Information technology
26	0.02	2013	Science
25	0.07	2010	Framework
25	0.05	2013	Impact
23	0.07	2007	Teacher
22	0.02	2014	Technology acceptance model
20	0.08	2007	Attitude
20	0.06	2008	Environment
20	0.03	2012	User acceptance
19	0.02	2015	Motivation
18	0.05	2011	Achievement
17	0.05	2009	Augmented reality
17	0.05	2015	Perception
17	0.05	2011	Strategy
17	0.03	2011	Teaching/learning strategy
16	0.04	2008	Mobile
15	0.02	2007	Ubiquitous learning

The keyword cluster themes can roughly be grouped into three large groups. Arcs model and mobile learning possess the earliest mean citation year. IT use, computer use in education, collaborative learning process, teaching/learning strategies, mobile phone, and education all have mean citation years that fall somewhere in the middle of our years of interest. More recent themes include technology acceptance model, games, and student achievement.

Cluster 1

With the advancement of wireless internet and 3G/4G/5G, contemporary teaching and learning have been transformed by the development of revolutionary technologies. Mobile learning can take place in any learning environment or space regardless of the type of mobile technology, learners, and learning methods [1]. For example, Chen and Chung [28] reported on a personalised mobile English vocabulary learning system based on item response theory and the learning memory cycle. As one of the most significant educational outcomes produced by the information technology industry, mobile learning has significantly changed when and where students can learn; it has created a situation where learners seamlessly switch between formal and informal contexts and between individual and social learning [29].

Several studies have indicated that mobile devices can improve students' achievements and enhance motivation [30]. As an example, Shih et al. [31] found a positive relationship between student learning and mobile device usage. Mobile devices enhance learning motivation through challenge, curiosity, control, recognition, competition, and cooperation [32]. Likewise, the use of radio frequency identification technology has been shown to encourage certain learning behaviours [33]. The use of mobile devices can also encourage cooperation between learners [34]. Similarly, Gikas and Grant [35] found mobile

computing devices and social media provided opportunities for student interaction and collaboration among peers. It allowed students to post content and communicate online.

Table 6. Keyword cluster analysis results.

Research Cluster Theme	Cluster Size	Silhouette Value	Mean Citation Year	Keywords (Top 10)
teaching/learning strategies	75	0.621	2013	Design, System, Performance, Teaching/Learning strategy, Interactive learning Environment, Challenge, Cognitive load, English, Elementary education, applications in the subject area
mobile learning	68	0.767	2009	Mobile learning, Education, Environment, Mobile, Ubiquitous learning, Computer, Case study, Wireless, Personal digital assistant, Informal learning
technology acceptance model	57	0.776	2015	Student, Higher education, Model, Acceptance, Adoption, Information technology, Technology acceptance model, User acceptance, Attitude, Perception
games	43	0.722	2015	Impact, Motivation, Achievement, Augmented reality, Collaborative learning, Game, Engagement, Online, Science Education, Feedback.
mobile phone	34	0.849	2013	Knowledge, Context, Pedagogical issue, Belief, Distance education, ICT, Media, Professional development, Cloud computing, Mobile phone
education	31	0.554	2013	Technology, Teacher, Experience, Self-efficacy, Antecedent, Language, Facebook, Authentic context
student achievement	29	0.744	2016	The device, Science, Mobile device, Instruction, Trend, Perspective, Adaptive learning, Smartphone, Integration
computer use in education	20	0.864	2011	Frame, Attention, Animation, Concept map, Computer uses in education, Construction, Museum learning, Working memory, Interactive learning environment, 2D barcode, Phone.
IT-use	10	0.928	2010	Classroom, School, TPACK, Video games, Schoolchildren, Cardiopulmonary resuscitation, Ubiquitous computing, Project-based science, Bystander CPR, Project-based learning
arcs model	7	0.988	2008	Learning object, Arcs model, motivational object, Handheld device, Computer-assisted instruction, Pedagogical agent, Message
collaborative learning process	7	0.935	2011	Communication, Team, Environmental awareness, Elementary, Collaborative learning outcome, Cognition, Collaborative learning process

Cluster 2

Researchers have highlighted several teaching strategies, models, and constructs related to mobile learning that have the potential of promoting students' learning effectiveness. These include a positive attitude [36], interactive concept map-oriented teaching [20], wearable technologies [37], online courses [38], information delivery medium [39], formative assessment-based mobile learning [40], enquiry-based learning [41], personalized mobile learning [42], MOOC platforms [43], and evidence-based approaches [44], among others.

Cluster 3

Learning and teaching model design is receiving increasing attention from researchers. Some examples include Al-Hmouz et al. [45] that designed an adaptive neuro-fuzzy inferencing system aimed at delivering adapted learning content to mobile learners and Shin and Kang [46] that extended the technology acceptance model to the investigation of students' acceptance of mobile learning in an online environment. Specifically, Shin and Kang's [46] study provided a better understanding of the mobile learning environment's influence on learning achievement. It should be noted that mobile learning is not without any drawbacks. Churchill and Hedberg [47] underscored that most mobile devices use small screens that could present several pedagogical and technological limitations.

Without location limitations, learning can occur anywhere, even in the outdoors [48]. Specifically, Land and Zimmerman [48] found utilising mobile devices can support informal science education outside the classroom by enhancing families' and children's learning experiences outdoors. Another example is Jong et al. [41], which developed Gamified Authentic Mobile Enquiry in Society (GAMES) to support students in conducting authentic outdoor inquiry-based learning. In a similar vein, Hung et al.'s [49] study reports on the development of a scaffolding framework in a mobile learning environment to support inquiry-based teaching. The framework has three layers: guided observation with multiple-choice items, independent observation with short response items, and extended observation with learning diary development. Based on the scaffolding provided by the mobile learning environment, students improved their competence in contextualisation, internalisation of ecological knowledge, and reflective thinking.

3.5.3. Keyword Burst Detection

Figure 7 displays the top 13 most frequent keywords in the analyzed papers. As no publications were produced between 2000 and 2002, the analysis was performed on years 2003 to 2021. The keywords appearing in the most recent years include: student, higher education, adoption, game, achievement, and intention.

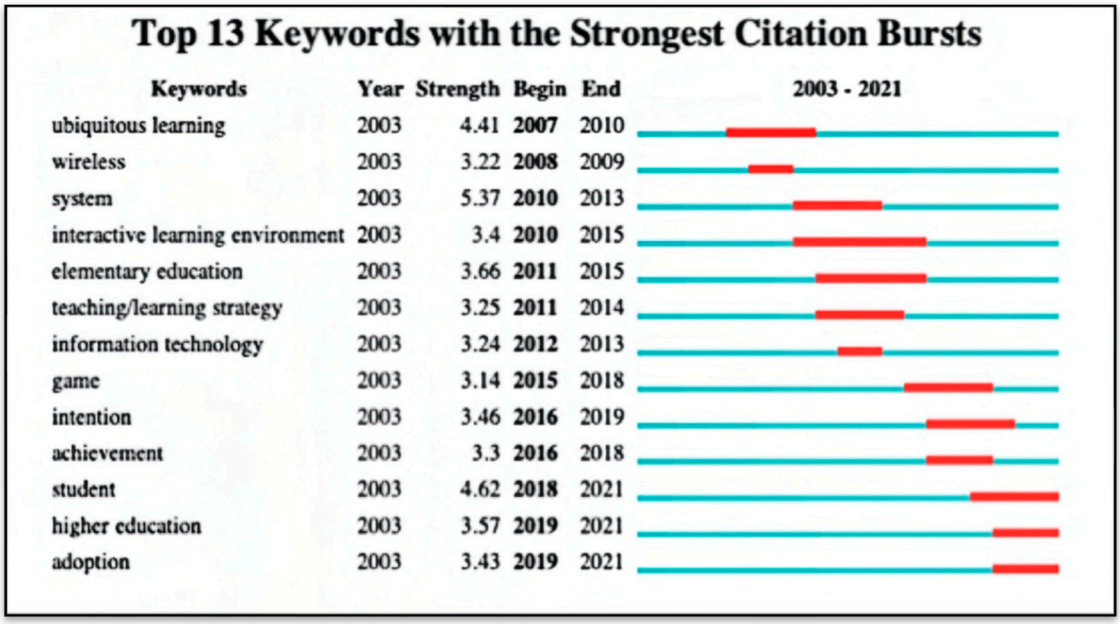

Figure 7. Top 13 keywords with the most robust citation bursts.

3.5.4. Co-Cited Literature Analysis

The citations of the five most frequently cited articles were extracted and are visualized in Figure 8. Their relevant information is provided in Table 7.

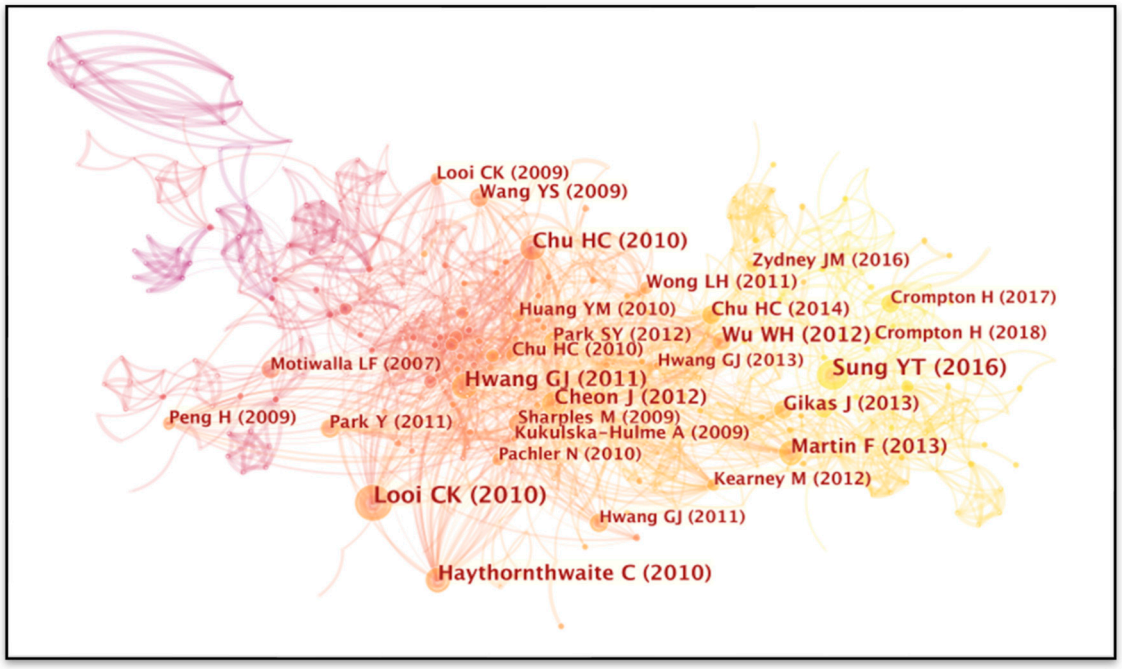

Figure 8. Co-cited literature analysis.

The top five high-frequency co-cited publications focused on the effectiveness of mobile devices. Looi [29] discussed mobile technology as a research agenda for sustainable seamless learning. Hwang and Chang [40] explained a formative assessment-based mobile learning model. Chu et al. [50] introduced *Mindtools*, an application to situate students in an environment that combines real-world and digital-world learning resources. Sung et al. [51] conducted a meta-analysis of 110 experimental and quasi experimental studies that found the application of mobile devices had a moderate effect on learning. Wu et al. [4] reported on the following trends from mobile learning studies: (1) their effectiveness and design; (2) how mobile devices have changed; and (3) how mobile learning is applied in professions and applied sciences.

Table 7. Articles with high-frequency co-citations.

Rank	Co-Citations	Centrality	Authors	Year	Title
1	27	0.11	Looi [29]	2010	Leveraging mobile technology for sustainable seamless learning: a research agenda
2	24	0.07	Sung et al. [51]	2016	The effects of integrating mobile devices with teaching and learning on students' learning performance: A Meta-Analysis and Research Synthesis
3	22	0.11	Hwang and Chang [40]	2011	A formative assessment-based mobile learning approach to improving the learning attitudes and achievements of students
4	20	0.07	Wu et al. [52]	2012	Review of trends from mobile learning studies: A meta-analysis
5	18	0.13	Chu et al. [50]	2010	A knowledge engineering approach to developing mindtools for context-aware ubiquitous learning

4. Conclusions

The aim of this study was to uncover: (1) the mobile teaching and learning publishing trends; (2) the prolific authors publishing and collaborating in publications on mobile

teaching and learning; (3) the prolific institutions and their collaborators publishing on mobile teaching and learning; (4) the countries/regions producing and collaborating on mobile teaching and learning research; and (5) the predicted mobile learning and teaching research hotspots and trends. Within the time frame examined, a noticeable increase in mobile teaching and learning articles started in 2008 and peaked in 2021. While research on mobile learning and teaching was found to have been produced throughout the world, the lion's share is from Taiwan. Notably, Gwo-Jen Hwang, along with other Taiwanese researchers, has paid substantial attention to this field. There is a noticeable collaboration between the authors that are producing most of the research in this field, with more research production resulting in more collaboration. This can be shown for not only individual authors but also countries/regions and for institutions. Keyword co-occurrence analysis and cluster analysis found 11 relevant clusters that could be narrowed down into three mobile learning and teaching hot topics. The most frequent keywords include: student, higher education, adoption, game, achievement, and intention. The most frequently cited publications dealt with the effectiveness of mobile devices for learning.

These findings provide scholars with an accessible summary of: (1) the current trends in mobile learning; (2) the active researchers in this field; and (3) the outlets that are most relevant for research produced on this topic. These findings have direct implications for the education and private sectors because mobile devices are not widely adopted in classroom settings and are often considered a learning tool more suited for out-of-class assignments or practice. Summarising the development of mobile learning, especially the effectiveness of mobile devices, allows for an understanding of the advantages and disadvantages of mobile devices for learning and instruction. Once the integration of mobile technology is actively initiated in the classroom by information technology educators, those in the technology industry should aim to develop mobile devices and relevant educational applications/software that can be utilised not only within the confines of the classroom but also to bridge in-class and out-of-class learning.

The findings of this study should be considered in connection with its limitations. First, the results are limited in that search terms for only SSCI-indexed journals were covered. If non-SSCI-indexed journals had also been included or other databases, the results would have differed. Second, the time span of analysis ended in 2021, which some might argue was still in the middle of the COVID-19 pandemic. It would be worthwhile for future research to compare these results before the pandemic to those after the pandemic.

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Institutional Review Board Statement: The authors of this paper confirm that the present study, entitled "A Bibliometric Analysis of Trending Mobile Teaching and Learning Research from the Social Sciences", is a systematic review and does not involve primary data collection, experimentation, or direct human subject research. As such, no human subjects, human material, or human data have been involved in the study, and therefore, the study is exempt from requiring Institutional Review Board (IRB) approval.

Informed Consent Statement: This systematic review adheres to established guidelines and methodologies. This study aimed to synthesis and analyses existing literature and published data to address the research questions outlined in the paper. The sources of information utilized in this study consist solely of publicly available, previously published research articles, reports, and other relevant documents. No personal, sensitive, or confidential information has been accessed or used during this study.

Data Availability Statement: In accordance with the data availability guidelines set forth by MDPI journals, we confirm that all the data used in this study can be found within the cited references. The full citation details of the included studies are provided in the reference list of this paper. Any additional information, files, or analysis tools used in this study can be made available upon reasonable request to the corresponding author at andyfan@um.edu.mo.

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