



Knowledge Base, Hot Areas and Development Context of Mobile Learning Research in China Citespace Analysis Based on CSSCI Database (2002–2021)

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Abstract. Through CiteSpace, this paper analyzes the literature on the theme of “mobile learning” from CSSCI journals from the knowledge base, research hotspots and development trends of mobile learning. The period of literature collection is 2002–2021. The conclusion is that the research on mobile learning has achieved rapid development, but the research field needs to be further broadened and deepened. The research institutions are mainly teachers’ colleges and universities, which can encourage more colleges and universities to participate in the research. More and more attention has been paid to the application effects of mobile learning, especially in the field of English language learning. With the development of artificial intelligence technology, intelligent research on mobile learning has become a research frontier and development trend in recent years. It can expand the application research of mobile learning in teaching practice of different levels and different objects.

Keywords: Mobile Learning · CiteSpace · Visual Analysis

1 Introduction

Mobile learning as a form of learning that enables individuals to gain experience through personal or collaborative learning through digital interactive activities using portable devices [1]. With the advancement of science and technology, communication technology and mobile devices have been rapidly developed, and mobile learning has been widely used in people’s living environment.

Mobile learning was first introduced into China at the 40th anniversary academic conference of Shanghai TELEVISION University. Irish distance education scientist Desmond Kilmore gave a report entitled “From Distance Learning to e-learning and then to mobile Learning”. Chinese scholar GUI Qingyang interpreted and commented on this, and thus opened the curtain of mobile learning research nationwide [2]. With the integration of information technology and various fields, more and more researchers pay

attention to mobile learning, and further carry out systematic theoretical research and thinking on mobile learning. For example, studies include mobile learning applications and systems [3] mobile learning teaching frameworks [4] mobile learning strategies [5] and mobile learning in teacher education [6]. In order to understand the latest situation and development trend of mobile learning in China, this paper explores its hot areas and development trend in a visual way, in order to provide useful reference for the subsequent research on mobile learning.

2 Data Sources and Research Methods

2.1 Data Sources

In order to ensure the comprehensiveness and reliability of the original data, this paper searches the CSSCI (Chinese Social Sciences Citation Index) journal papers included in the Chinese Journal Database (CNKI) with the subject word “mobile learning”. After removing invalid literature, a total of 859 papers were obtained.

2.2 Research Methods

This paper adopts the method of bibliometric statistics to conduct an overall analysis of mobile learning research from the aspects of annual publication of documents, distribution of core authors, and distribution of research institutions. Then, CiteSpace software [7] is used to visualize the data and draw a scientific knowledge map with key words as the main content, so as to grasp and analyze the research hotspot and development context of mobile learning in China.

3 Data Analysis and Results

3.1 Spatial And Temporal Distribution of Literature

1) Analysis of annual distribution of literature

The number of papers published each year is an important indicator to measure the popularity and development trend of mobile learning research. As shown in Fig. 1, before 2006, domestic CSSCI journals published no more than 4 papers per year. The number of papers on mobile learning has increased since 2007. It can be seen that Chinese scholars have gradually increased their attention to mobile learning research topics. However, from 2009 to 2021, the number of papers published in mobile learning showed ups and downs, especially after 2018, the number of papers dropped sharply.

There may be two reasons for this. Firstly, in the field of mobile learning, related research has reached a certain saturation. Secondly, with the progress of the research, the depth and innovation of the research need to be further strengthened to enhance the research value of this paper.

2) Analysis of distribution of core authors and institutions

The core author is the backbone force to promote the development of disciplines and academic innovation. Digging and analyzing their academic activities can effectively identify the research status and development of different disciplines [8].

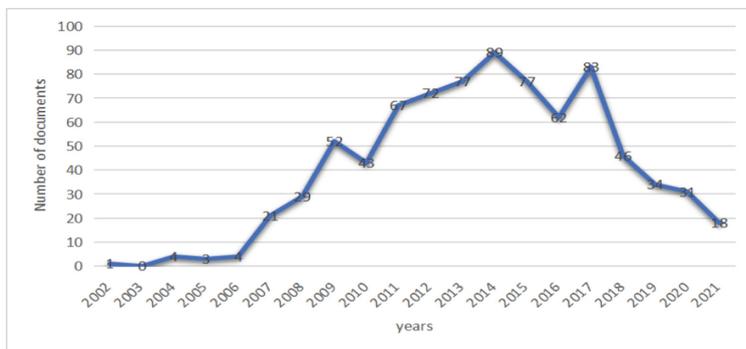


Fig. 1. Distribution of CSSCI journals on mobile learning from 2002 to 2021. (self-drawing)

First, mining and analyzing the academic activities of the core authors is conducive to grasping the current research status and development context in this field. In addition, the number of publications and the frequency of citations reflect the author's scientific research productivity and academic influence in terms of quantity and quality [9]. As shown in Table 1, statistics show that since 2002, there are 16 high-yield authors who have published more than 6 papers. The two scholars who have published the most papers are from Zhejiang University of Technology and Beijing Normal University, demonstrating their active research in the field of mobile learning.

Then, citation frequency is an important symbol of peer recognition, which indicates the trust of academic community on scholars, and also reflects the contribution and influence of scholars on the development of the discipline [9]. Table 2 lists the distribution of the top ten scholars highly cited in CSSCI journals in the field of mobile learning in China since 2002 and the titles of the literatures they published. Scholar YE Cheng-lin topped the list with 890 citations, followed by Zheng Xiaojun with 811 citations and He Kekang with 800 citations. Yu Shengquan and Li Qing both appear in the list of highly prolific authors and highly cited authors. It indicates that since 2002, the above scholars have had a high contribution rate and influence in the research field of Mobile learning in China and are the core figures in the academic community of mobile learning research. In addition, their research focuses on the development process of mobile learning research, as well as the design of mobile learning methods and learning environments, indicating that these two aspects are the core points of concern for many researchers.

3) Analysis of research institutions

Mobile learning research has formed several relatively stable research institutions. The top five published Schools are Beijing Normal University (83), East China Normal University (38), South China Normal University (32), Capital Normal University (25) and Northeast Normal University (24). It can be seen that normal universities are the main force in the research field of mobile learning at the present stage and have achieved fruitful academic achievements.

Table 1. Distribution of high-yield authors in mobile learning research (publications ≥ 6). (self-drawing)

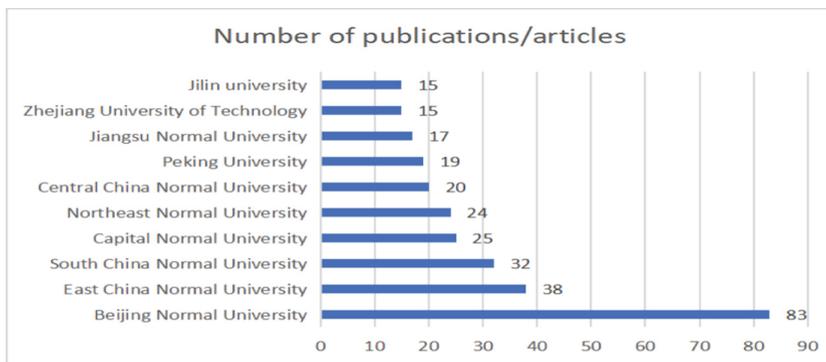
Author	Organization and region	Number of publications
Li Hao-jun	Zhejiang University of Technology, Hangzhou	11
Huang Rong-huai	Beijing Normal University, Beijing	11
Ffang Hai-guang	Capital Normal University, Beijing	10
Yu Sheng-quan	Beijing Normal University, Beijing	10
Wang Min-juan	San Diego State University, USA	10
Xiao Jun-hong	Shantou Open University, Shantou	9
Gu Xiao-qing	East China Normal University, Shanghai	9
Chen Lin	Jiangsu Normal University, Xuzhou	8
Zhu Zhi-ting	East China Normal University, Shanghai	7
Li Qing	Beijing University of Posts and Telecommunications, Beijing	7
Gu Feng-jia	East China Normal University, Shanghai	6
Su Zhong	Capital Normal University, Beijing	6
Xiang Jing	Zhejiang University of Technology, Hangzhou	6
Wang Wei	Northeast Normal University, Changchun	6
Wang Yi-ning	Northeast Normal University, Changchun	6
Li Yu-Shun	Beijing Normal University, Beijing	6

3.2 Analysis of Mobile Learning Research Hotspots

High-frequency keywords can reflect research hot-spots in a certain field [10]. Keywords are highly generalizations of the topic of the literature. Through the analysis of the high-frequency subject words, hot issues in the research field can be inferred [11]. In order to more accurately reflect the research hotspots in the field of “mobile learning”, the author used the analysis software CiteSpace to map the keywords into the co-occurrence network graph and carried out econometric analysis on the keywords of mobile learning CSSCI journals from 2002 to 2021. As shown in Table 3 and Fig. 3, the high frequency keywords from high to low are: mobile learning, educational technology, college English, blended learning, cloud computing, flipped classroom, college

Table 2. Distribution of highly cited authors in mobile learning research. (citation frequency \geq 65) (self-drawing)

Author	Document title	Cited frequency	year
Ye Cheng-lin	A review of mobile learning research	890	2002
Zheng Xiao-jun	Six Doubts about Micro-Lesson and Responses to the Doubts	811	2014
He Ke-kang	New progress of educational informatization theory research in China	800	2011
Li Qing	MOOC: A giant open course model based on connectionism	748	2012
Wang Ping	Analysis of Support Functions and Design Principles of Mobile Learning Based on Wechat	723	2013
Wang Mi	Micro-video courses: Evolution, Positioning and Application fields	693	2013
Ye Cheng-lin	Mobile learning and its theoretical basis	605	2004
Yu Sheng-quan	Design of Micro-lecture Based on Learning Cell System	582	2014
Yu Sheng-quan	From knowledge transfer to cognitive construction to situational cognition -- the development and prospect of three generations of mobile learning	558	2007
Guo Shao-qing	Review of mobile learning applications abroad	547	2011

**Fig. 2.** Top 10 Institutions (Units: Papers) by Publications. (self-drawing)

student, distance education, mobile learning resource, content analysis, context awareness, assignment design, instructional design, design principle, digital learning, online learning, artificial intelligence, English learning and learning environment.

It can be seen that the hotspots of CSSCI journals from 2002 to 2021 are concentrated in the field of education, including mobile learning methods, mobile learning

Table 3. Mobile learning high frequency keyword statistics. (self-drawing)

Keywords	Frequency
mobile learning	207
educational technology	15
college English	12
blended learning	11
cloud computing	9
flipped classroom	9
college student	9
distance education	9
mobile learning resource	8
content analysis	7
context awareness	7
instructional design	6
higher education	5
design principle	5
digital learning	5
online learning	5
artificial intelligence	5
English learning	5
learning environment	5

environments, mobile learning resources, mobile information technology, etc. In other words, the hot research fields of mobile learning can be summarized as the discussion of mobile learning technology, the reform of mobile learning methods, the construction of students' mobile learning platform and the application effect of mobile learning. It can be seen that the focus of mobile learning is from the initial connotation definition to the evaluation of mobile learning environment and personalized design guidance. In this process, the focus is essentially on the impact of mobile learning applications on students in the classroom environment.

3.3 Analysis of the Development of Mobile Learning Research

Burst refers to the occurrence frequency of a certain keyword in a specific period of time with a very large fluctuation [12] and means that they receive special attention in the corresponding time interval [9]. According to Gui Qingyang, the research hotspot of mobile learning has experienced the development process of knowledge transfer, cognitive structure and situational cognition [13].

Figure 4 lists the 12 keywords with the highest quoted mutation values, followed by flash lite, cloud computing, instructional design, online learning, content analysis,

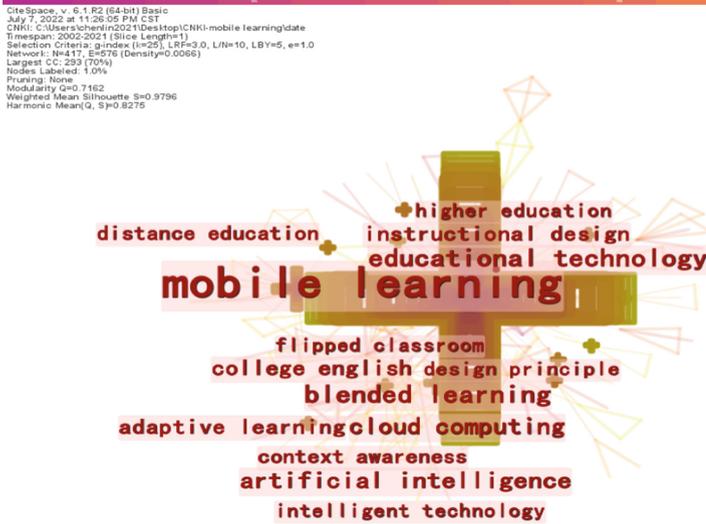


Fig. 3. Keyword co-occurrence map. (self-drawing)

Top 12 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2002 - 2021
flash lite	2002	1.56	2007	2010	
cloud computing	2002	1.9	2009	2013	
instructional design	2002	2.22	2011	2013	
online learning	2002	2.66	2014	2015	
content analysis	2002	1.65	2014	2016	
flipped classroom	2002	2.88	2015	2017	
activity theory	2002	1.93	2016	2017	
digital learning	2002	1.71	2016	2017	
artificial intelligence	2002	2.58	2018	2021	
college english	2002	1.71	2019	2021	
mobile-assisted language learning	2002	1.64	2019	2021	
intelligent technology	2002	1.64	2019	2021	

Fig. 4. Keyword mutation map of mobile learning research. (self-drawing).

flipped classroom, activity theory, digital learning, artificial intelligence, college English, mobile-assisted language learning, intelligence technology. To some extent, this represents the research frontier and development trend of mobile learning in recent years. Judging from the trajectory of vocabulary mutation in recent years, mobile learning has been widely used in English language learning, and with the rise and development of artificial intelligence and intelligent technology, mobile learning and intelligent technology are more and more closely integrated.

4 Research Conclusion

In this paper, the research documents related to mobile learning published in CSSCI from 2002 to 2021 in CNKI are taken as the investigation objects, and the basic hot areas and development context of mobile learning research are analyzed. Four conclusions can be drawn from this study:

- The related research in the field of mobile learning has attracted extensive attention of Chinese scholars and has achieved rapid development. However, in recent years, there has been a decreasing trend in the research popularity of mobile learning, which to some extent indicates that there may be a saturation of research in this area. In this sense, the content of the research field of mobile learning needs to be further broadened and deepened by researchers.
- In academia, the institutions of mobile learning research are mainly centered on normal colleges, and most of them are concentrated in some developed cities, which may be related to the development of local economy and the emphasis on mobile technology. Therefore, it may be considered to promote the application of mobile learning on a national scale and promote research in this field by other research institutions.
- By analyzing the frequency and mutation of mobile learning research keywords, it can be seen that with the development of mobile learning research, its hotspots have experienced the development process of knowledge transfer, cognitive structure and situational cognition, and the research on the application effect of mobile learning has become more and more. More and more, especially in the application of English language learning. Moreover, with the development of artificial intelligence and intelligent technology, the intelligence of mobile learning is the research frontier and development trend in recent years. Therefore, researchers can combine the current intelligent development of information technology to expand the application research of mobile learning in teaching practice at different levels or different objects. For example, in early childhood science education, through various vivid, interesting and gamified mobile learning apps, the immersive and realistic video simulation methods in the apps are used to provide children with in-depth understanding and reflection in scientific inquiry. These initiatives enable young children to experience and see, touch and feel learning in action, remember what they have learned, understand their own concepts, and assess children's capacity for scientific inquiry.

Acknowledgment. This research is supported by the "14th Five-Year Plan" of Fujian Province Educational Science Regular project support in 2022 (Grant No. FJJKBK22-015).

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