



The Historical Evolution Graph of Digital Learning Power Research in China (2004-2024)

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Abstract

This study relies on the rich database resources of China National Knowledge Infrastructure (CNKI) and uses advanced CiteSpace visualization analysis software to systematically explore the development trend and pattern of digital learning power themes in journal literature over the past two decades. Through detailed temporal graph analysis, this study prospectively reveals several key trends in the evolution of digital learning capabilities, emphasizing the deep integration of digital technology and online learning environments, innovative transformation of teaching design concepts and models, and the importance of cultivating digital literacy and student core abilities. Given the core position of digital learning in the current wave of education reform, this study not only systematically reviews and summarizes the research achievements and dynamic trends in this field, but also further contributes forward-looking and practical strategic recommendations. Intended to provide a solid theoretical foundation and directional guidance for subsequent academic exploration and educational practice in the field of digital learning, promoting the deepening of research and the broadening of applications in this field.

Keywords

Digital learning ability; Learning ability; Development trends; CiteSpace

1. Raise a question

Providing education that satisfies the people is an important task proposed in the report of the 20th National Congress of the Communist Party of China, with a special emphasis on accelerating the digitization of education. The digital transformation of education is a comprehensive, systematic, and all-round innovation and transformation process, which not only directly affects the quality of talent cultivation in China, but also profoundly affects the digital transformation development of the entire society and the competitive advantage of the country (Zhu Zhiting & Hu Jiao, 2022). The Central Commission for Cybersecurity and Information Technology issued the "Action Plan for Enhancing Digital Literacy and Skills for the Whole People" in 2021, which pointed out that in order to achieve the transformation from a cyber power to a cyber power, the key is to improve the digital skills and literacy of the whole population, adapt to the needs of the digital age, promote comprehensive personal development, and improve national quality. This is a strategic responsibility aimed at meeting the requirements of the digital age and achieving the country's development goals. Implement training on the application ability of digital technology for teachers, enhance their ability to use digital technology, and improve their awareness and ability in education and teaching (Zou Yunlong & Chen Hongyan, 2021).

2. Study design: Sample data and study methods

This study used bibliometric analysis to conduct an in-depth analysis of the literature in the China National Knowledge Infrastructure (CNKI) database. Intended to delve into the current research status and future trends of digital learning power. The study used the CNKI database as the data source and systematically sorted out the current research context and core issues of digital learning power by drawing a research graph. On this basis, this study provides a professional analysis and description of the current status and potential development trends of digital learning in China, aiming to provide strong academic support and strategic suggestions for accelerating the construction of an education powerhouse.

2.1 Sample data

The sample data for this study is sourced from the China National Knowledge Infrastructure (CNKI) database, and a systematic literature search is conducted through a refined keyword retrieval strategy, which involves splitting and merging the core keyword of "digital learning power". The search scope is limited to literature published between 2004 and 2024, and a total of 1221 effective literature closely related to the topic was preliminarily screened. Subsequently, after a rigorous literature screening process, invalid data with low relevance to the research topic was removed, and finally, 621 high-quality and effective literature was selected. The research areas of this literature mainly focus on key academic topics such as "digital chemistry learning ability", "digital learning power", and "digital learning ability", demonstrating the richness and depth of research on digital learning ability.

2.2 Study methods

In this study, the bibliometric method was used to conduct a thorough analysis of the literature in the CNKI database. Through the use of CiteSpace software, this study makes a visual comparative analysis of the time distribution of research literature, keyword frequency, research trend, and other key elements, aiming to reveal the core research hotspots and development trend of digital learning power in the field of education in the past two decades. In the parameter setting of CiteSpace, we set a time range from 2004 to 2024 and a time slice of one year to ensure the timeliness and continuity of the data. At the same time, in order to ensure the focus and clarity of the research map, we adopted the analysis threshold of $\text{topN}\%=50\%$, and used the Pathfinder algorithm to cut, so as to generate a high-quality related research map, to assist us in the professional analysis and interpretation of the research status and development trend of digital learning power in the field of education.

3. Study results and analysis and comments

3.1 Overall trend study

Using the Pathfinder algorithm and setting one year as a time slice, the total number of literature in the CNKI database from 2004 to 2024 was statistically analyzed. It can be seen that the research literature on digital learning power has shown an overall increasing trend and reached its peak in 2014, 2017, and 2024; Since 2012, it has experienced rapid growth. This article divides the development of this research field into three periods, as shown in Figure 1.

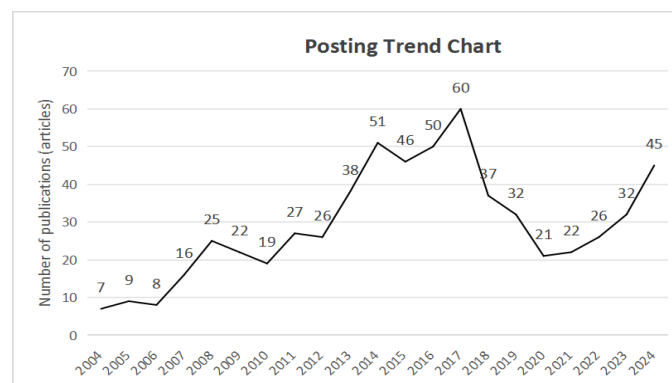


Figure 1. Line chart of publication volume from 2004 to 2024.

3.1.1 Stage 1: 2004-2011

In the early stages of digital learning research, there was a significant increase in research literature in this field from scratch, reaching a small peak in 2011, with the number of articles increasing to 27. During this period, relevant research mainly focused on defining and understanding the concept of "digitalization", as well as exploring its development trends and potential impacts in the field of education.

3.1.2 Stage 2: 2012-2017

In the early stage of the second stage of digital learning research, although the number of publications in 2012 was slightly flat, with only 26 articles, the research output of the entire stage showed a significant fluctuation and upward trend. By 2017, this trend had reached a clear peak, with a surge in literature publication to 60 articles. Compared to the previous stage, the average annual publication volume had significantly increased.

3.1.3 Stage 3:2018 to the present

At this stage, the number of literature publications shows an inverted V-shaped trend. Since 2018, the number of publications has gradually declined and reached its lowest point in 2020. However, from 2021 to 2024, the number of publications began to significantly increase, indicating a resurgence and deepening of research interest.

3.2 Keyword co-occurrence and map research

3.2.1 Keyword co-occurrence map

The co-occurrence graph of keywords shown in Table 1 reveals the main research directions and current hot topics in the field of digital learning power. The size of these circular nodes directly reflects the frequency of the keyword appearing in the literature, that is, the larger the node, the more times the keyword is mentioned in the literature, and thus it can be determined that it is a hot topic in current research.

Table 1. Co-occurrence of keywords in the field of digital learning power

Importance	Keywords
Main keywords	Digitization, Community education, University student, Information technology, Lifelong learning, Learning resources, Apply, Self-directed learning, Internet+, Information literacy
Secondary keywords	Digital literacy, Learning environment, Core literacy, Mobile learning, Ability to learn, Learner, Influencing factors, Artificial intelligence, Vocational students, Share, Educational Reform Project, Vocational education, Analyse, Informatization, Digital competence, Flipped classroom, Online learning

3.2.2 Keyword protruding map

Figure 2 shows the distribution of high-frequency words in the literature in the field of digital learning in the past two decades. The bold lines in the diagram highlight the sudden emergence of certain high-frequency words in a given year.

Top 17 Keywords with the Strongest Citation Bursts

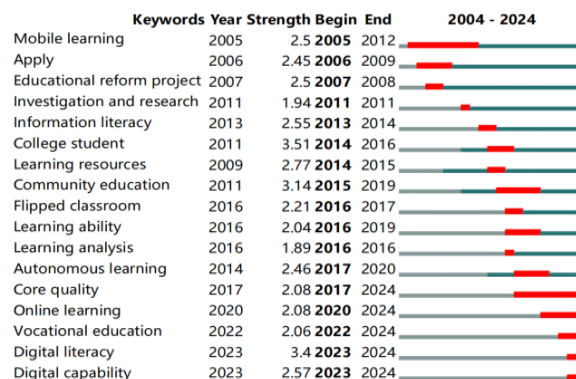


Figure 2. Keyword Emergence in the Field of Digital Learning Power.

3.2.3 Keyword clustering chart and analysis content

In this study, Pathfinder, Pruning Sliced Networks, and Pruning the Merger Network algorithms (Li Deming et al., 2023) were used to conduct an in-depth analysis of the research literature in the field of digital learning. Clusters #0 to #9 represent keyword clusters of different sizes, with cluster #0 containing the largest number of keywords and representing the main research directions in this field (see Figure 3).

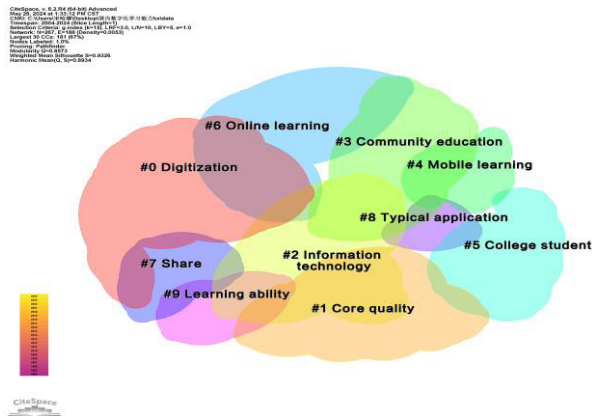


Figure 3. Keyword clustering diagram in the field of digital learning power.

(1) The core elements of digital learning power

This section includes two clusters, #0 digital and #9 learning ability, and the keywords involved include learning space and vocational students. Judging from the keywords included in the above keyword clustering, the current field of digital learning power pays more attention to the application of digital learning technology and the formulation and implementation of effective improvement strategies. Together, these concerns have led to in-depth research and continued development in the field of digital learning.

(2) Application and cultivation of digital learning ability

This section includes four clusters: # 2 information technology, # 4 mobile learning, # 6 online learning, and # 8 typical applications. These elements together constitute the foundation and pursuit of digital learning power and promote the creation of high-quality educational resources tailored for students.

(3) Cultivation environment and object of digital learning ability

This part includes four clusters: # 1 core literacy, # 3 community education, # 5 college students, and # 7 sharing. The keywords involved include Internet Plus, lifelong learning, digital literacy, and learning resources. From the keywords included in the above keyword clusters, it can be seen that digital chemistry learning focuses more on diversified learning resources and models, communities, and lifelong learning. Learners should master the necessary application ability to apply digital technology, so as to effectively make use of diversified learning platforms and resources, and actively participate in community-driven lifelong learning activities, so as to promote the educational progress and knowledge sharing of the whole society while continuously deepening personal core literacy.

3.2.4 Time zone map: Research hot spots and future trends

The chart's findings highlight some disparities in research within associated disciplines. To aid in the visualization process, the features are compiled in Table 2 in this publication.

Table 2. Analysis of research trends in digital learning power hotspots from 2004 to 2024

2004-2011	This stage focuses on basic education, teaching models, mathematical abilities, and creativity.
2012-2017	This stage focuses on vocational education, information technology, open universities, and learning platforms.
2018-2024	This stage focuses on artificial intelligence, Internet plus education, college students and social learning.
Research Trends	Technology integration is revolutionizing education across levels, with lifelong learning gaining popularity via open universities and online platforms. There's a growing emphasis on educational equity, leveraging digital tools to enhance rural education quality. Innovation capability is a central theme in digital learning research in China, reflecting a commitment to tech-education fusion, lifelong learning, equity, and talent cultivation for a dynamic educational evolution.

4. Revelation

4.1 National leadership: innovation-driven, digital technology leads the future education reform

From the perspective of national strategy, promoting the implementation of innovative digital technologies requires careful planning and the introduction of a series of policies and strategic plans. China can strengthen the digital skills of educators and learners and provide necessary hardware support. The primary task is to build a comprehensive and systematic information literacy framework based on China's national conditions and the actual development of digital technology. Under the guidance of the information literacy framework, further construct a scientific and reasonable evaluation index system to evaluate the development status of individuals, organizations, and even the entire society in digital technology application, innovation capabilities, and information literacy, providing data support and decision-making basis for policy formulation and adjustment (Wang Bin & He Yanfang, 2022).

4.2 School practice: focus on ability and build an educational ecology with learners as the core

Schools should provide advanced infrastructure for education (Lv Meng & Li Deming, 2024). Innovative methods like project learning and flipped classrooms can enhance students' critical thinking, innovation, and problem-solving abilities, fostering a lifelong learning and all-round development environment. Training teachers and learners in advanced digital skills is crucial to ensure they can utilize emerging technologies and tools for teaching and learning, respectively, cultivating professional digital talents. Integrating digital learning into classrooms benefits both students and teachers.

4.3 Management innovation: change the educational mode to adapt to the educational needs of the digital age

The rapid improvement of digital learning ability is leading the education mode to experience a profound transformation, among which the traditional direct face-to-face teaching mode is gradually giving way to online education, many new teaching methods such as mixed learning. These emerging teaching modes give learning individuals higher flexibility, intelligence level, and environmental adaptability, and create a more personalized learning path. To adapt to this change, education stakeholders must develop plans to educate and train teachers on digital competencies to enhance their digital learning capabilities and ensure that teachers are able to take full advantage of digital technologies to optimize teaching and learning (Luo Shengquan & Zheng Xinrui, 2023).

5. Conclusion

In summary, through the detailed data analysis of the literature related to digital learning in China in the past two decades, the core position and significant value of digital learning in education and learning are revealed. For educators, the active use of educational technology to enhance learners' learning has become a critical task. Therefore, from the perspective of building learning ability, in-depth exploration and strategic planning of educational practice are of great academic significance and practical value for promoting educational innovation and development.

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