Analysis of Research Hotspots and Trends in k12 Online Education in China

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Abstract. Education informatization in China has been greatly promoted in recent years, along with the popularity of the network technology and the smart terminal, and the breakthrough in big data and cloud computing technology, K12 online education grows rapidly, it’s especially necessary to comprehensively know about the development history of domestic K12 online education, research status and hotspots, thus further explore the development direction of K12 online education. In this paper, Citespace software is used to visualize the journal papers and master's degree papers collected in CNKI database and draw K12 keywords co-occurrence and the research hotspot in the research of the K12 online education change sequential graph, and we found K12 online education research focused on the "basic education", "Internet +", "online learning space", "online school" and "business model", etc., indicating that K12 online education develops with the national education informatization and, and turns the way of Market-oriented Development.

Keywords: online education, K12, research hotspots, visual analysis.

1. Introduction
"Information technology has revolutionary impact on education development and must be highly valued."K12 education informatization in China has been greatly improved, K12 online education tends to be personalized and interactive, focusing on the cultivation of students' personality and creativity. At present, K12 online education has a huge scale, with various educational platforms and products emerging in endlessly. Relevant research is gradually launched. In this paper, CiteSpace is used to carry out quantitative analysis and visual analysis of the retrieved K12 online education related literature, presenting the hot issues of K12 online education research intuitively.

2. Research design & methods
2.1. Research tools and methods
Citespace software was used to visualize the data in this study, and Knowledge Domain Mapping and Co-word Analysis of literature were used to analyze the data.

2.2. Data collecting
Literature selection: This study takes the CNKI database as the source, adopts the "K12 online education" as the key word, or includes "online learning" or "K12 online learning" or "digital learning",
or "online education in primary and secondary schools" or "online education", or "basic education", and contains "Internet +" search periodicals and papers, set from January 1, 2001 to July 1, 2019, excluding some conference announcements, draft invitations and other non-related literature on research topics, and ultimately collected 275 effective documents.

Data processing steps:
Document Exporting: 275 papers were obtained through CNKI advanced search and manual screening, and were output in Refworks and Endnote file formats in the document management center. Drawing atlas of the research hotspot: using Citespace software to import Refworks text for transformation, and draw the keywords atlas. Constructing co-occurrence matrix: using SATI software, importing EndNote text and transforming it into EndNote format, extracting information such as "source (journal)" and "year".

3. Results

3.1. Overall development trend of K12 online education research

![Figure 1](image)

Figure 1. Number and trend chart of K12 Online Education research literature.

Through the number and trend chart of literature published, we find the overall development trend of K12 Online Education research in China. Figure 1 presents a statistical analysis of the literature published in 2001-2019 on K12 Online Education research, showing that K12 online education research has been on the rise in recent years, and we can even divide the trend into two stages:

Potential stage (before 2012), this stage, the number of documents is relatively small, but in a slow and increasing development, resulting in that China's information technology foundation is weak, the Internet has not been widely used before 2012, especially in the vast rural areas.

Outbreak stage (after 2012), in September 2012, Vice Premier Liu Yandong proposed at the National Teleconference on Education Informatization Work that during the 12th Five-Year Plan period, we should focus on the construction of "three links and two platforms", namely "broadband network School-to-School links, high-quality resources class-to-class links and network learning space for all", and build public service platforms for educational resources and educational management.K12 online education has been greatly exposed and Scholars have explored the development of K12 online education. With the gradual advancement of exploration, problems, obstacles and emerging hot spots have emerged, and related research has fallen back.
3.2. Analysis of journal titles

Figure 2. Journal sources.

The 275 papers are widely distributed in 179 journals. Fig 2 shows the top 10 journals and the number of specific papers, they are "Middle school educational technology", "China Education Info", "IT Education in Primary school and Middle school", "China Educational Technique & Equipment", "China Education Technology", "China Information Technology Education", "Education Information Technology", etc, totaling 63 articles, accounting for 22.6% of the total periodicals, indicating that K12 online education related research involves a wide range of fields. At the same time, through the analysis of these 12 journals, we can see that the publications such as "China Education Info", "China Education Technology", "e-Education Research" and "Modern Education Technology", are the core journals in the field of educational technology and educational informatization, reflecting K12 online education is closely related to information technology and Internet.

3.3. Analysis of hotspots in K12 online education research in China

Visual presentation of research hotspots

Import 275 valid documents selected from CNKI into Citespace software to draw hot spot maps, as shown in Figure 3. In the hot spot map, the bigger the circle is, the higher the frequency of keywords appears. The keywords with centrality greater than 0.1 are represented in purple, regarded as key nodes.
According to the frequency order, the first 16 high frequency keywords are presented, as shown in Table 1.

**Table 1.** Frequency and centrality of high frequency keywords.

| Count | Centrality | Year  | Keywords                                      |
|-------|------------|-------|-----------------------------------------------|
| 42    | 0.86       | 2014  | Online Education                              |
| 30    | 0.37       | 2014  | Middle&Primary school                         |
| 24    | 0.22       | 2015  | Internet Plus                                 |
| 21    | 0.07       | 2015  | K12                                           |
| 17    | 0.42       | 2015  | Elementary Education                          |
| 14    | 0.00       | 2011  | Teacher of Middle&Primary school              |
| 10    | 0.05       | 2017  | "Internet Plus"                               |
| 9     | 0.14       | 2014  | Online Learning                               |
| 7     | 0.02       | 2010  | Educational informatization                   |
| 5     | 0.05       | 2017  | Network Learning Space                        |
| 5     | 0.05       | 2015  | Network                                       |
| 4     | 0.00       | 2015  | Ministry of Education                         |
| 4     | 0.00       | 2016  | Network+Education                             |
| 4     | 0.00       | 2010  | Teacher Training                              |
| 3     | 0.00       | 2015  | Business Model                                |
| 3     | 0.00       | 2018  | AI                                            |

**Figure 3.** K12 hotspot map of online education research.
Based on the key words of high frequency and high school centers in Fig. 3 and Table 1, the research hotspots of "K12 Online Education" in China from 2001 to 2019 can be analyzed as follows:

K12 online education is obviously dominated by the state and government. Whether it is time node or research content, it coincides with national planning. In 2012, the Ministry of Education proposed to build a nationwide "three links and two platforms". This led to the development of related research on "K12 online education", and spawned the research hotspots of "learning space", "Education Internet +" and "basic education informatization". It focused on the combination of K12 education and Internet technology, and explored the basic problem of resource construction of K12 online education, so as to meet the needs of students' personalized learning and realize the individuality and creativity of K12 online education. K12 education informatization and learning resources development become the eternal topic of online education research.

Although online education aims at satisfying students' individualized needs and cultivating students' creativity, and reducing teachers' dominant position in teaching activities, the role of teachers still plays a decisive role in K12 online education at this stage. The key lies in how to position the role of teachers. In addition, in the information age, the abilities that teachers should possess are worth discussing.

China's education informatization has always been dominated by the government, but from the research hotspots of "business model" and "artificial intelligence" in the past three years, it can be seen that K12 online education research has gradually advanced. The research direction is to remove the administration in K12 online education, turn to market-oriented, and explore the new route of development of K12 online education.

Visualization Analysis of the Change of Research Hotspots

According to the above hot spot analysis, the time sequence diagram of hot spot change is generated by Citespace in chronological order, as shown in Figure 4.

![Figure 4](image_url)

Figure 4. Transition sequence map in research hotspots of K12 online education.

We can see that before 2012, due to the underdevelopment of computer and information technology and limited network coverage, K12 online education related research mainly focused on education informatization and teacher training. One is the process of education informatization at the national level, the other is the training of elementary and secondary school teachers to improve their information technology capabilities. The object and content of the study are relatively single, and the number of studies is small. After 2012, with the advancement of the national "three links and two platforms", the content of online education research in China has become increasingly rich and diversified. In addition to the informatization process of K12 education, academia is actively exploring the most critical and
core issues of "business model", "online school" and "online learning space" of K12 online education. The research is deepening, showing the market-oriented trend of K12 online education. With the leap-forward development of information technology in recent two years, "artificial intelligence" has entered the field of research, indicating that K12 online education research keeps up with the trend of the times and maintains close contact with cutting-edge technologies of the times.

3.4. Conclusion and reflections
Through searching and analyzing the related literature of K12 online education in CNKI, suggesting that 2012 is the watershed of the development of online education and research in K12. On the one hand, national policies and government forces have a significant impact on K12 online education and related research, both in the rate and quantity of development. The development of K12 online education is closely related to the process of national education informatization. On the other hand, the state and government vigorously promote the "double Creation" and "Internet+", vigorously introduce market subject. The core elements of K12 online education, "learning space" and "business mode" have received great attention, showing the trend of K12 online education marketization. The introduction of cutting-edge technology such as artificial intelligence has confirmed this. They are introduced to further enhance the K12 online education market advantage.

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