



Analysis of the Elements of Special Education Development in the Context of Information-Based Education

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Abstract. In the new era, embedding modern informatization technology in the field of special education is an inevitable trend in the development of special education. Using Citespace software, this paper combines the basic characteristics of the development of special education informatization in China at this stage, and constructs an analytical dimension system of special education informatization concept with the core dimensions of infrastructure, teaching resources, technology application, and technology application. Based on the dynamic evolution of special education informatization, the study concludes that a systematic big data platform for special education information disclosure needs to be built to promote the sharing of special education informatization resources among regions in order to narrow the differences in the level of special education informatization among regions and improve the overall development level.

Keywords: Information-based education · Special education · Development status · Element analysis

1 Introduction

1.1 Research Background

In the context of the development of the Internet and information technology, special education informatization is an important part of education modernization and a core challenge to promote the equity of educational resources, improve the quality of all people and people's well-being [3]. In response to the reform policy of "comprehensively promoting quality education" and giving full play to the role of the Internet and informatization in special education, China has promulgated "The Ten-Year Development Plan for Education Informatization (2011–2020)" and "the Fourteenth Five-Year Plan" [5]. At the same time, with the development of information technology, especially under the guidance of the idea of "inclusive education", special education has become a research topic for more and more experts and scholars, and the development of information technology in the field of special education has gradually received attention. By the end of 2020, 2288 special education schools were established in China, providing special

compulsory education for children with hearing, visual and intellectual disabilities, and 69,400 teachers and workers were engaged in special education. In conclusion, how to improve the informatization level of special education schools, promote the modernization of special education schools, and promote educational equity and the healthy physical and mental development of special education students is the current direction of special education development in the context of information-based education.

1.2 Research Methodology

This paper uses the data analysis method and Citespace software to analyze the literature about special education informatization, and summarize the factors affecting the development of modernization of special education by summarizing the data, to suggest the direction for the optimization of special education informatization development.

2 Document Analysis

Based on the literature published in journals included in China National Knowledge Infrastructure (CNKI) from 2000 to 2022, an advanced search was conducted with the subject terms of “special education informatization” and “special education”, and 14,781 academic journals were obtained. The source categories of academic journals were limited to Peking University Core, CSSCI, and CSCD, and the invalid samples were removed to obtain 500 search results. Subsequently, Citespace software was used to analyze the keywords in the literature, and the word frequency was calculated as follows.

$$TF = \text{freq}(i, j) / \text{maxlen}(j) \quad (1)$$

$\text{Freq}(i, j)$ denotes the number of times a word $w(i)$ appears in article j , and $\text{maxlen}(j)$ denotes the total number of words in article j . The larger the TF value, the more frequently the word appears in the article. However, since “we”, “they” and other such words do not affect article classification, it is necessary to add the inverse document frequency (IDF) parameter, which is calculated as follows:

$$IDF = \log\{\text{len}(D) / n(i)\} \quad (2)$$

The formula $\text{len}(D)$ denotes the total number of articles D , and $n(i)$ denotes the number of articles in which the $w(i)$ vocabulary appears. When the number of articles containing a word is greater, the IDF value of this word is smaller. Finally, the TF-IDF value of each term $w(i)$ can be calculated using the above concept with the following formula:

$$TF - IDF = TF \times IDF \quad (3)$$

Using the above algorithm to analyze 500 academic journals, the graph shows that the “knowledge mapping” type of special education research literature has received much attention in the past five years, and “integrated education” and “information technology” have been gradually included in the research scope in recent years. In recent years, “integrated education” and “informatization” have also been gradually included in the scope of research. Therefore, the development of special education has become a major trend in the context of information-based education (Fig. 1).

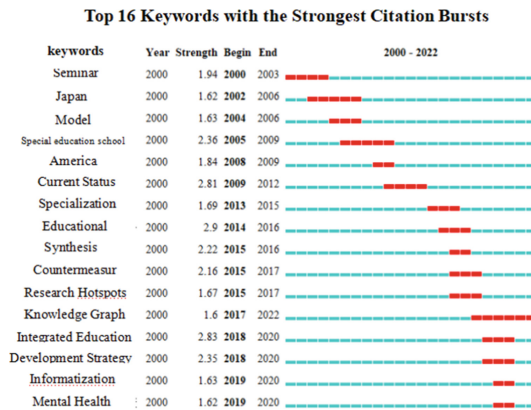


Fig. 1. Top 16 Keywords with the Strongest Citation Bursts.

3 The Four Elements of Special Education Information Development

With the continuous development of education in China, information technology and big data network gradually enter the classroom and achieve good benefit [1], and the application of information technology in the teaching of general schools shows the direction for the further development of special education schools. In this paper, through the summary analysis of the existing data, combined with the analysis of information technology construction goals, the following summary is made on the elements affecting the development of special education informatization in China since the 21st century.

3.1 Analysis of Infrastructure Construction

Special education in China started late and has not been developed for a long time. Therefore, the construction of special education infrastructure is bound to be the primary factor limiting the development of special education information technology. According to the data published by the National Bureau of Statistics and the Ministry of Education of the People’s Republic of China, I summarize the number of schools, enrollment, and graduation of special education schools in China from 2011 to 2021 (Fig. 2).

From the above table, we can see that in the past ten years, the data of special education schools in China have shown steady growth, and special education enrollment, attendance and graduation have gradually become mature. The data show that the more special education schools there are, the more special education students are enrolled, the higher the penetration rate of special education, and the greater the role of information technology in the special education business. It can be seen that increasing the enrollment rate of special education students is the first step in the development of special education information technology.

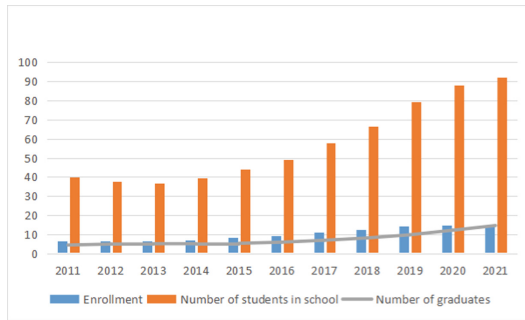


Fig. 2. Basic situation of Special Education Schools in China

Table 1. Construction of laboratories and computer rooms in special education schools in different areas.

Province	Laboratory	PC-room	Proportion
Jiangsu	18800.53	9939.48	8.97%
Shandong	18163.70	12442.19	7.38%
Hebei	8607.75	10128.58	7.19%
Hubei	4308.61	5488.79	5.88%
Tibet	104.00	267.42	1.55%
Xinjiang	2361.02	3163.64	5.47%

3.2 Analysis of Information Technology Education Resources

The development of special education informatization cannot be separated from various types of informatization education resources, i.e., the construction of informatization classrooms and the construction of teachers in special education schools. The differences in informatization education resources in each region reflect the level of development of special education informatization in each region. Therefore, this paper divides China into three regions, namely, east, middle and west, with Jiangsu and Shandong as examples in the eastern region, Hubei and Hebei in the central region, and Xinjiang and Tibet in the western region, and compares the construction of teaching and supporting rooms and teachers’ strength in six provinces (Table 1).

In terms of the size of special education school staff in each province, the number of special education full-time teachers in each province in the eastern region is more than 3000, the provinces in the central region have about 1000 to 3700 full-time teachers in special education schools, and the provinces in the western region have fewer special education full-time teachers, all less than 1500. In terms of the education of special education full-time teachers in each province, bachelor’s degree accounts for the largest proportion, but the education of the provinces in the eastern region is generally higher than that in the central and western regions, with hundreds of full-time teachers with

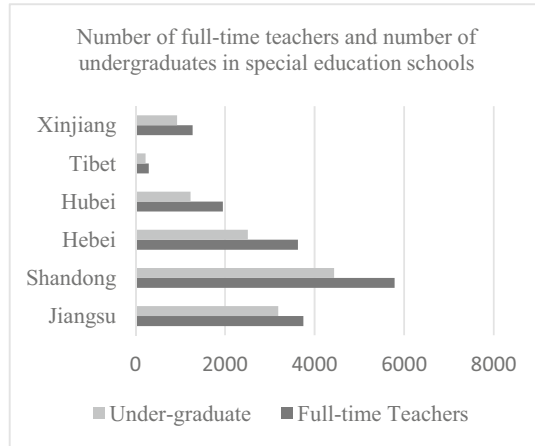


Fig. 3. Number of full-time teachers and number of teachers with bachelor degree in special education schools.

graduate degrees. Thus, it can be seen that the number and level of special education full-time teachers in the east, central and west regions differ greatly, and the teacher capacity shows a gradual decline from east to west, thus reflecting the east-west difference in the level of special education informatization in China (Fig. 3).

In recent years, China has continued to regulate the conditions of special education schools, making clear provisions for electronic information technology educational facilities such as laboratories and microcomputer rooms. In terms of the setting of information technology education facilities, the provinces in the eastern region require special education schools to have electronic information technology facilities accounting for more than 7% of the teaching and support rooms, the provinces in the central region require electronic facilities accounting for between 5% and 7%, and the provinces in the western region have a relatively low percentage of special education electronic information equipment at less than 6%. In general, the more developed the information technology and economy are, the higher the importance of teachers' teaching level and information technology equipment construction, and the faster the development of special education informatization [2].

3.3 Analysis of Information Technology Teaching Application

The rational use of information technology by teachers in the classroom is the most significant indicator of improving the level of information technology in special education. Through the informatization training for special education teachers, the widespread use of various teaching terminals is promoted to fully mobilize special students' learning attention and initiative in the classroom, thus achieving the purpose of improving teaching effectiveness. The higher the degree of relevant informatization training, the more extensive the application of informatization teaching, and the more rapid the development of special education informatization. Therefore, the application of information

technology teaching tools in special schools is a key element in the development of special education informatization.

3.4 Analysis of Information Technology Education Laws and Regulations

Since 1982, the overall number of policies and regulations promulgated in China regarding special education has been on the rise, and the Ministry of Education has formulated relevant educational policies to address the different educational issues faced by special education students, gradually refining the work of special education in China [4].

In addition to the public documents on “special education”, the number of policies and regulations containing the term “inclusive education” is also increasing. In general, the development of special education needs corresponding policies and regulations to escort the development of special education, and the development of special education information technology also needs the support of information technology education-related laws.

4 Conclusions

Based on the above model analysis and data survey, we can see that the relevant factors affecting the development of special education informatization include four dimensions: infrastructure, teaching resources, technology application, and information-based education policy. First, the infrastructure dimension includes the number of schools, the number of enrollment, the number of students and the number of graduates. Secondly, the teaching resources dimension includes the number of school staff, the academic qualifications of full-time teachers, and the construction of electronic informatization education facilities such as laboratories and microcomputer rooms. In addition, the dimension of technology application factor includes the informatization training of special education teachers and the application of informatization teaching methods. Finally, the dimension of policies and regulations includes the laws related to informatization education.

From the above data analysis, we can see that if we want to break through the current situation of special education informatization development in China and improve the efficiency of using information technology in the special education business, we must establish a systematic big data platform for special education level information disclosure, including special education informatization software design, informatization equipment application, and information training for full-time teachers’ teaching ability [6]. The purpose is to accelerate the establishment of sound special education informatization development issues. In brief, the development of special education informatization is promoted by mastering the relevant factors affecting the development of special education informatization, summarized as follows.

Document margins must be the following:

- Increase financial expenditures for the construction of information technology in special education schools, and improve the construction of information technology infrastructure for special education;

- To strengthen support for a highly educated full-time teaching force for special education in the western region, and to narrow the gap in information technology levels between the East, the Middle and the West;
- Improving special policies and regulations on special education informatization to enhance the rationality and legality of the development of special education informatization.

In general, the development of special education informatization in China is relatively rapid at this stage, and it will become a frontier topic in the field of special education for some time in the future. Therefore, it is not enough to analyze the factors that affect the development level of special education informatization through Citespace software and related data, and there is still a long way to go for the research of special education informatization.

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