# Research Hotshots and Development Trend of Intelligent Education in China—Analysis Method Based on Multidimensional Scaling

Quan Jiangtao[a]  Cui Can[b*]

*Teaching and Research Support Center, Dalian Naval Academy, Dalian, Liaoning116018, China*
[a]  *Email: qjt15940821888@163.com*
[b*] *Corresponding author. Email: 1083404968@qq.com*

**ABSTRACT**
A deep understanding of the research hotshot and development trend in the field of intelligent education in China will help researchers to grasp the latest development of intelligent education more accurately and promote the rapid development of intelligent education in China. This paper adopts the method of multidimensional scale analysis, using BICOMB 2.0, SPSS 23.0 and other software, taking CSSCI as the source of literature data, analyzes the research hotshot and development trend of intelligent education in China. The research shows that the current research focus of intelligent education mainly includes the basic theory research of intelligent education, the application research of artificial intelligence technology in education, the research of intelligent education teaching mode and so on. The future research of intelligent education should pay attention to the fields of higher education and maker education, strengthen the construction of educational practice and teaching mode, and promote educational reform and personnel training.
*Keywords: intelligent education, multidimensional scaling, research hotshot, development trend*

## 1. INTRODUCTION

As a subversive technology, artificial intelligence is applied in education to optimize the teaching process, teaching design and feedback, making the teaching area personalized, more predictive and participatory, bringing breakthrough progress in the field of education, and providing new solutions and new ways for the creation of human-computer cooperation, cross-border integration, CO creation and sharing in the field of Education[1].

The notice of the State Council on printing and distributing the development plan of the new generation of artificial intelligence formally put forward the concept of "intelligent education" for the first time, emphasizing that we should seize the major strategic opportunity of the development of artificial intelligence, use intelligent technology to accelerate the reform of talent training mode and teaching method, and build a new education system including intelligent learning and interactive learning.

### 1.1. Research and design

This research selects "intelligent education" as the subject word through CNKI retrieval platform, and the source is limited to CSSCI retrieval source journals. The retrieval time is August 22, 2019, and the retrieval time span is all time periods. According to statistics, 344 papers were retrieved in this study, and 233 papers were finally included in the analysis after eliminating the articles not related to this study, such as repeated publications. In this study, 233 papers were extracted from CNKI and saved in Firstborn format and user-defined format for subsequent analysis using related research tools. In this study, BICOMB 2.0 and SPSS 23.0 are used as research tools, and the methods of Co-word analysis and Multi-dimensional scaling are used.

### 1.2. Research results and analysis

#### 1.2.1 Analysis of the number and content of papers

Based on the quantitative and qualitative analysis of 233 papers included in the analysis, this paper summarizes and summarizes the current situation of intelligent education research in China, and analyzes and considers the results. Domestic research papers on Intelligent Education are mainly published in professional journals of education technology. It shows that the researchers of educational technology pay more attention to the concept of intelligent education, and the research is more in-depth. According to the statistics of the number of intelligent education papers published each year, as shown in Table 1, intelligent education has become a research hotshot since 2017. In 2018, the number of papers on intelligent education has exploded. In 2019, the number of papers has reached 73 in

eight months. The number of future research on intelligent education will continue to grow.

**Table 1 Number of Intelligent Education Papers (as of August 2019)**

| Years | Frequency of occurrence | Years | Frequency of occurrence |
|-------|------------------------|-------|------------------------|
| 2019 | 73 | 2010 | 2 |
| 2018 | 97 | 2009 | 4 |
| 2017 | 20 | 2008 | 5 |
| 2016 | 5 | 2007 | 4 |
| 2015 | 3 | 2006 | 5 |
| 2013 | 1 | 2003 | 2 |
| 2012 | 5 | 2001 | 1 |
| 2011 | 4 | 2000 | 2 |

### 1.2.2. Key words frequency statistics and analysis

After the keywords are standardized, the high frequency threshold $M=0.749\sqrt{Nmax}$, is determined according to the priced formula. *Nmax* represents the highest cited frequency of the author in the literature. According to the search results, according to the rounding principle, the number of high-frequency keywords $M = 4$, a total of 28 high-frequency keywords. The statistical results are shown in Table 2.The frequency of 28 key words is more than 4, and the total frequency is 364. The research on artificial intelligence, intelligent education, intelligent education and educational information is mostly focused on.

### 1.2.3. Key words dissimilarity coefficient matrix

In this study, we use BICOMB 2.0 software to analyze 28 keywords and get dissimilarity matrix. The co-occurrence matrix is an undirected symmetric matrix whose diagonal values represent the word frequency of keywords. In order to further analyze and mine the relationship between key words, this study introduces the discourse matrix into SPSS, and selects *Ochiai* to transform it into *28×28* common word similarity matrix. The partial difference matrix is shown in Table 3. The concepts of intelligent education and artificial intelligence appear at the same time Rate > the probability that intelligent education and other key words appear at the same time.

### 1.2.4. Clustering analysis of key words

Import all the data of the high-frequency keyword dissimilarity matrix in Table 3 into SPSS 23.0 for cluster analysis, and use cluster analysis method to obtain the cluster tree diagram of high-frequency keyword, so as to further clarify the development trend of domestic intelligent education. The result of keyword clustering can further reflect the relationship between relatives and relatives of keywords. Through the co word clustering analysis, the theme words

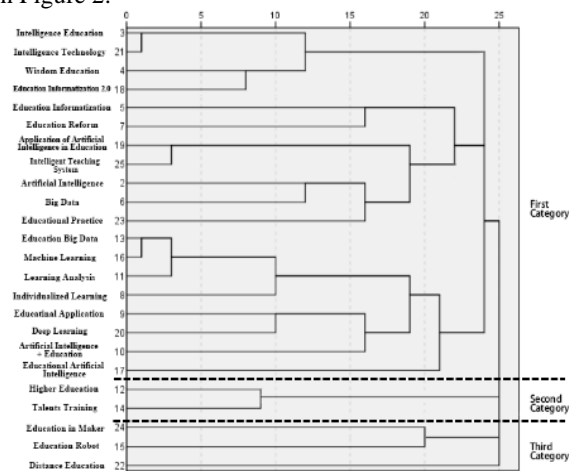with strong distance gather to form similar clusters, as shown in Figure 2.



**Figure 1** Clustering tree of keywords in intelligent education research

### 1.2.5. Key words multidimensional scale analysis

In this study, SPSS 23.0 was used to analyze the dissimilarity matrix of 28 high-frequency keywords, and Z-score was selected as the standardized method. *Stress* = 0.25811, *RSQ* = 0.62373, and the fitting effect is good. Intelligent education is in the first quadrant, which is closely connected with educational information and other three research fields. In the second quadrant, the research on artificial intelligence and educational application is unstable and vulnerable to the influence of other fields. The relationship between the keywords in the third quadrant is the most loose, and the connection between the intelligent teaching system and the artificial intelligence education application is relatively close, but the research results are few and they are on the relatively marginal position. The key words in the fourth quadrant are relatively concentrated, which is reflected in the future research of intelligent education. In the era of artificial intelligence, we should pay attention to the fields of higher education and maker education, strengthen the construction
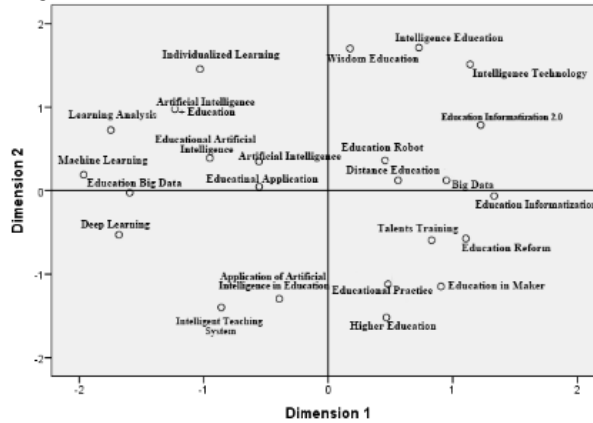
**Figure 2** Hot knowledge map of intelligent education research

**Table 2 High frequency keyword frequency statistics (part)**

| Serial number | Key fields | Frequency of occurrence | Serial number | Key fields | Frequency of occurrence |
|---|---|---|---|---|---|
| 1 | Artificial intelligence | 140 | 7 | Personalized learning | 11 |
| 2 | Intelligence education | 25 | 8 | Education application | 10 |
| 3 | Wisdom education | 16 | 9 | Artificial intelligence + Education | 10 |
| 4 | Education informatization | 15 | 10 | Learning analysis | 9 |
| 5 | Big data | 12 | 11 | Higher education | 8 |
| 6 | Education reform | 11 | 12 | Education big data | 8 |

**Table 3 high frequency keyword dissimilarity matrix (part)**

| | Artificial intelligence | Intelligence education | Wisdom education | Education informatization |
|---|---|---|---|---|
| **Artificial intelligence** | 0.000 | 0.811 | 0.807 | 0.867 |
| **Intelligence education** | 0.811 | 0.000 | 0.750 | 0.948 |
| **Wisdom education** | 0.807 | 0.750 | 0.000 | 0.871 |
| **Education informatization** | 0.867 | 0.948 | 0.871 | 0.000 |

## 1.3. Research hotshot analysis

### 1.3.1.The basic theory research of intelligent education

Although the research of intelligent education in China is just in its infancy, the existing research has explored the basic theory of intelligent education. Guo Shaoqing pointed out that intelligent education is an important part of the new education system in the future, and it will tend to mature and form a new direction of pedagogy. DU Wei[3] summed up and analyzed the principles to be followed in the ethics of intelligent education, and put forward a more profound reflection on intelligent education.

### 1.3.2.Research on the application of artificial intelligence technology in Education

At present, intelligent education in China has taken root in various fields. Many experts and scholars in the fields of teacher education development, ideological and political education, programming education and so on have conducted research and reflection, and discussed the importance of innovation and localization of intelligent education. LU Kaiyue applied artificial intelligence to the field of teacher education development, and discussed the professional development trend of teachers in the era of artificial intelligence, the role function of teachers under the reform of classroom teaching, educational technology and other topics. WU Dongsheng analyzed how to effectively use the path of artificial intelligence in Ideological and political education, and strives to shape and cultivate "indigenous people in the

era of artificial intelligence" with active learning, communication and creativity.

### 1.3.3.Research on the teaching mode of intelligent education

In the research of intelligent education and teaching mode, it has been discussed and reflected from the perspectives of basic education, vocational education, talent training program, etc. How to integrate AI technology with education has become one of the key problems in the application of education and teaching. ZHENG Qinghua[4] proposed to promote intelligent education with artificial intelligence, so as to improve the quality of personnel training, explore the mission, positioning, characteristics and direction of personnel training in Higher Education in the new era, and promote the deep integration of modern information technology and educational teaching management evaluation services. CAI Huiying analyzed the influencing factors of teachers' knowledge development in the era of intelligence, so as to promote the sustainable development of maker education in China.

## 2. CONCLUSION

### 2.1. Improve the theoretical system of intelligent education

Intelligent education needs to build its own independent knowledge system and method system step by step. In terms of concept and connotation, it is clearly divided from the field of intelligent education. In academic circles, we should form a unified universal understanding of intelligent education, and clarify the connotation and characteristics of related concepts. Pay attention to the education theory system under the background of artificial intelligence, and analyze it from different perspectives. It is not only necessary to study the new education theory system supported by artificial intelligence technology, but also to pay attention to the education and learning science perspectives in intelligent education. Domestic researchers should strengthen the combination of theory and practice, try to localize intelligent education supported by artificial intelligence technology, go out of Chinese characteristics in the development of intelligent education, and further enhance the academic status of China in the field of intelligent education.

### 2.2. Pay attention to interdisciplinary and interdisciplinary application

At present, the research scope of intelligent education in China is relatively large, and the number of papers issued is increasing year by year. There are many interdisciplinary and interdisciplinary researches on intelligent education. However, from the perspective of practical application and empirical research, artificial intelligence technology has not been applied to all fields of education and teaching, and has not yet provided sufficient guidance for the teaching activities of all disciplines. In the implementation of intelligent education, we should learn from the ideas and methods of applying artificial intelligence in other fields, integrate the technology of artificial intelligence with the concept of education and teaching, further expand the application field of intelligent education, effectively promote the development of intelligent education, and provide theoretical support and practical basis for the application of artificial intelligence technology in education. The future research of intelligent education should pay attention to the fields of higher education and maker education, strengthen the construction of educational practice and teaching mode, and promote educational reform and personnel training.

## REFERENCES

[1] GUO Shaoqing, Appeals of "Internet + Education" to the Development of Education Theories, Journal of East China Normal University (Educational Sciences), 37(4)(2019) : 25-37.

[2] HU Wei, Education Reform in the Age of Artificial Intelligence: Background, Direction and Path——Based on the Analysis of American Artificial Intelligence Reports, Modern Educational Technology, 29(7)(2019): 12-17.

[3] DU Jing, HUANG Ronghuai, LI Zhengxuan, Connotation and Construction Principles of Artificial Intelligence Ethics in the Era of Intelligent Education,40(7)(2019) :21-29.

[4] ZHENG Qinghua, AI: Lights up Intelligence Education, Lifts up Talents Training Quality, Research in Higher Education of Engineering, 6(4)(2019):128-132.