A Visual Analysis of Information Technology Literacy of Rural Primary and Secondary School Teachers in China

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Abstract. This paper uses CiteSpace 6.1.R2 software to draw a knowledge map of the literature related to "teachers' information technology literacy" in CNKI as a research sample, and analyzes the current situation, hot spots and development trend of information technology literacy of rural primary and secondary school teachers in China. The research results show that the number of relevant studies has been increasing year by year in the context of Internet+ education. For the current situation of low IT literacy among rural primary and secondary school teachers, more and more attention is paid to its development and cultivation under the support of rural revitalization strategy.

Keywords: teachers' information technology literacy · rural education · research hotspots · development trend · knowledge mapping · visual analysis

1 Introduction

With the rapid development of information technology in the new era, information technology courses in primary and secondary schools have also kept pace with the times, enriching teaching resources, optimizing educational means and updating communication channels in terms of classrooms; expanding subject knowledge, reforming traditional models and improving teaching effectiveness in terms of teachers. Teachers' IT literacy refers to their ability to understand and apply information technology, specifically in reading, processing and using information about education and teaching.

Information technology, as a frontier subject of today's rapid social development, is increasingly becoming an emerging position in education development, but there are also problems such as a large gap between urban and rural informatization and uneven distribution of resources [2]. The vast majority of rural primary and secondary schools lack information resources, and rural teachers still use traditional book-based indoctrination teaching in classes due to the lack of scientific and systematic IT training, and the perennial single teaching method leads to rural education remaining difficult to make effective breakthroughs under the huge potential and promotion of current education policies and environment. The Ministry of Education issued the Opinions on Implementing the National Primary and Secondary School Teachers' IT Application

Ability Enhancement Project 2.0 in 2019, aiming to promote the national primary and secondary school teachers to enhance their IT application ability, promote the progress of urban and rural IT teaching levels toward balanced and high quality, optimize and innovate the IT teaching methods, modes and atmosphere in rural schools, and improve the comprehensive IT literacy of teachers and students in rural primary and secondary schools. promote the overall development of rural primary and secondary school students [3].

2   Research Program

2.1   Sample Source

The sample data of this study was obtained from CNKI database, and 348 journal papers were searched under the theme of "teachers' IT literacy", and 24 journal papers were searched under the theme of "rural teachers' IT literacy". The total number of articles searched was 372, including 76 articles from CSSCI sources. The remaining documents were incorporated into CiteSpace 6.1.R2 software for knowledge mapping analysis, and a sample database was established.

### 2.2   Research Tools and Methods

The research tool used in this study is CiteSpace, a visualization tool developed by Professor Chao-Mei Chen of Drexel University, which is used to systematically analyze data in a certain field by bibliometric methods and to quickly derive the research themes, research status, hotspots and evolutionary time series of the field [6]. In this study, we used CiteSpace 6.1.R2 software to create a knowledge map of "rural primary and secondary school teachers' information technology literacy" research. The current research status, hotspots and development trend of "rural primary and secondary school teachers' IT literacy" were presented through a series of knowledge mapping analysis of annual publication volume and keywords.

3   Analysis of Research Results

3.1   Keyword Co-occurrence Analysis

Keywords are the extraction of the core content of an article, and by viewing journal keywords can clarify the main research direction of the paper, reveal the main content, and present the trend of topic research. As shown in Fig. 1, to further understand the current research status of IT literacy of rural primary and secondary school teachers, a keyword co-occurrence knowledge map was generated using CiteSpace 6.1.R2 software on the basis of annual publication statistics.

From the nodes in the figure, we can see that the high-frequency terms of research on "rural primary and secondary school teachers' IT literacy" are mainly information technology, curriculum teaching, information literacy, teaching methods, core literacy, informatization, etc. Several research hotspots cover the main subjects, contents and strategies of rural primary and secondary school teachers' IT literacy.
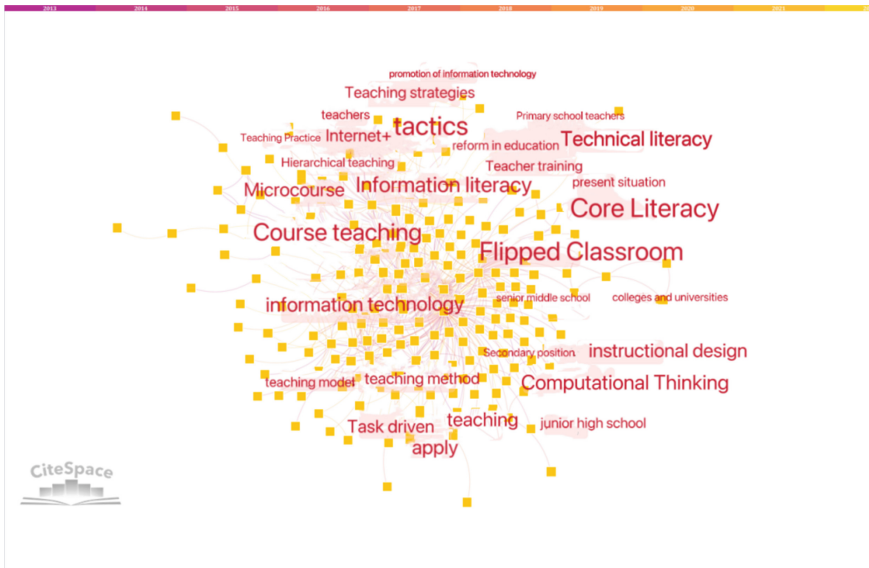
Fig. 1. Knowledge map of IT literacy keywords for rural primary and secondary school teachers

3.2 Keyword Timelines View

In the keyword Timelines view analysis, Q value can illustrate the clustering structure, and the larger Q value indicates the better clustering structure, and S value can be used to measure the degree of homogeneity of clusters, and the larger S value indicates the higher degree of homogeneity of clusters [5]. When Q is greater than 0.3 and S is greater than or equal to 0.5, it indicates that the result of clustering is reasonable, where when S is greater than or equal to 0.7, it indicates that the clustering is highly efficient and has convincing power. As shown in Fig. 2, Q = 0.5696, S = 0.8708, which indicates that the keyword Timeline knowledge map of this thesis about rural primary and secondary school teachers' IT literacy is credible. According to the Timeline view, the stage changes of rural primary and secondary school teachers' IT literacy and the hot topics of research at each stage can be analyzed.

3.3 Keyword Surprise Analysis

By analyzing the keyword emergence, we can understand the research hotspots, development trend and changes in a certain time period, etc.

As shown in Fig. 3, two key words, flipped classroom and micro-lesson, appeared in 2015 and 2016, respectively. Since 2015, with the in-depth development of the new teaching mode of flipped classroom and micro-lesson, more emphasis has been placed on cultivating teachers' IT literacy. The research at this stage focuses more on practice, the cultivation of teachers' IT awareness, and the cultivation of operational skills.

The three key words appearing in 2019: rural, status quo, and rural teachers, originate from the Opinions of the CPC Central Committee on Implementing Rural Revitalization
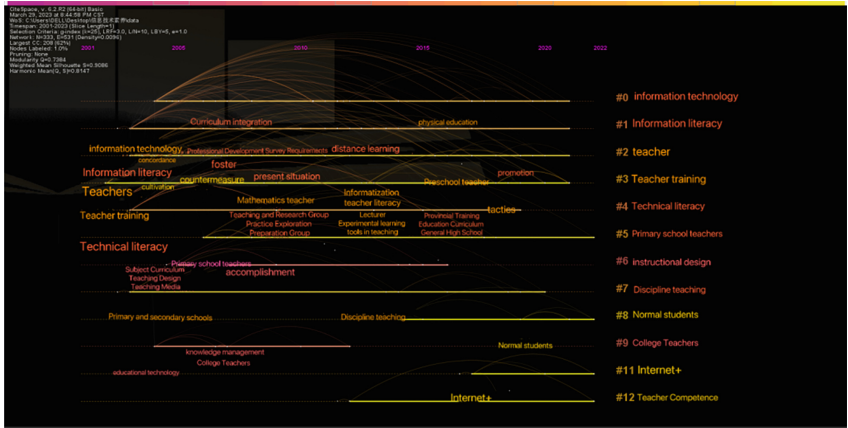
Fig. 2. Timeline view of IT literacy keywords for rural primary and secondary school teachers

Top 5 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2013 – 2023
High school	2014	3.5	2014	2015	
New Curriculum	2014	2.87	2014	2015	
Flipped Classroom	2015	3.18	2016	2017	
Core Literacy	2019	4.99	2019	2021	
Microcourse	2016	2.9	2019	2020	

Fig. 3. Emerging knowledge map of IT literacy keywords among rural primary and secondary school teachers

Strategy promulgated by the CPC Central Committee and the State Council in 2018; this document is meant to win the victory in building a moderately prosperous society, while it has also set off a wave of rural revitalization research in the field of education. In response to the current situation that most rural primary and secondary school teachers lack IT literacy, vigorously improving rural primary and secondary school teachers' IT literacy has become a major measure to promote rural modernization [10].

4   Questions and Suggestions

Based on the visual analysis of the mapping, we can understand the current situation of low information technology literacy of rural primary and secondary school teachers, summarize the important factors affecting the information literacy of rural primary and secondary school teachers at the present stage in China, and give feasible suggestions to improve the information literacy of rural primary and secondary school teachers according to the influencing factors, so as to promote the improvement of information literacy of rural primary and secondary school teachers and the balanced development of urban and rural education [11].

4.1   Improve the Availability of Resources

The uneven distribution of resources due to the urban-rural development gap and the inadequate provision of information technology equipment are the biggest differences between rural and urban education [12]. Therefore based on the theoretical basis of improving the provision of information resources, it is not only necessary to guarantee the availability of physical multimedia equipment in each rural primary and secondary school, but also to strengthen special training for teaching staff on information technology, effectively enabling every teacher to participate in special lectures and to regularly attend schools with sound information technology teaching for learning and further training. If it is inconvenient to be there because of the distance or other reasons, it is also necessary to actively develop the form of online training to participate in learning and achieve the optimal use of expert resources [13].

4.2   Enriching the Evaluation System of Teachers

In the Internet+ era, rural education resources are gradually enriched, and the learning of rural primary and secondary school teachers has also shifted from passive to active, so a more diversified and three-dimensional approach should be used to evaluate the information technology teaching of rural primary and secondary school teachers in a scientific and reasonable way [14]. For example, the use and effect of teachers' information technology teaching can be included in the evaluation index, specifically the behavior of improving rural primary and secondary school teachers' information technology literacy by combining multimedia teaching, classroom and information technology as the necessary requirements for teachers' teaching, and increasing the improvement of teachers' information technology literacy from the hard index.

4.3   Creating a Culture of Information-Based Teaching

Through the study and understanding of the advantages of information-based teaching, teachers' awareness of information-based teaching is improved, they fully realize the necessity of improving information technology literacy, consciously change the inherent ideas and modes of traditional classroom teaching, and fundamentally solve the problem of low information technology literacy [15]. In addition, schools should create a cultural atmosphere of informatization teaching from various aspects such as environment, equipment, and so on, so that teachers and students can accept the subtle influence of informatization teaching, which can better promote the progress of informatization teaching while improving the information technology literacy of teachers in rural primary and secondary schools.

4.4   Strengthening the Practice of Information-Based Teaching

Under the popularity of information-based teaching, rural primary and secondary schools gradually have more information-based equipment, but each school still has only a few smart classrooms or multimedia function rooms, which is a big difference with urban teaching resources. Rural school administrators can't afford to buy additional equipment

to avoid damage, not allowing teachers and students to use it at will, or require a series of cumbersome procedures such as application and approval, making it difficult for teachers to access the equipment, usually as a decoration or only for "standard products" for higher inspection [16]. Therefore, school leaders need to change their mindset at the right time, and increase encouragement and support for school teachers to use modern information teaching methods to carry out teaching, so that multimedia equipment in the classroom to play a real role.

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