A Bibliometric Analysis of Research on Teachers' Digital Literacy in the Context of Artificial Intelligence

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The article surveys the research papers in CNKI on digital literacy, analysing the current status and hotspots of teachers' digital literacy research in terms of the annual trend of paper publication and the co-occurrence of keywords. The results of the study show that digital literacy research is divided into steady growth and rapid growth periods with 2021 as the boundary, and the research content mainly focuses on the two core themes of technology and education, in which the research hotspots of teachers' digital literacy mainly focus on the integration of technology and pedagogical innovation, the impact of ChatGPT on teachers' professional development, the strategy of teachers' digital literacy enhancement, the digital support and teacher development, and the teachers' professional development and digital divide.

Keywords: artificial intelligence, teachers' digital literacy, bibliometric analysis

Introduction

Digital literacy has become one of the necessary core competencies for teachers in the 21st century. With the application of artificial intelligence technologies, such as ChatGPT in the field of education, it is very important to improve teachers' digital literacy to promote the development of education. ChatGPT, as a natural language processing technology based on deep learning, its application in the field of education not only changes the existing teaching mode, but also puts forward a new requirement for teachers' digital literacy. Therefore, a comprehensive analysis of the current research status of teachers' digital literacy is particularly necessary. Collecting records of digital literacy research papers in CNKI, this study uses bibliometric analysis to reveal the current status, hotspots, and trends of teachers' digital literacy research in the era of artificial intelligence.

Data Source and Data Processing

In this paper, CNKI database is used as the source of literature data, and the literature searched is limited to Chinese literature, the matching mode is "exact", and the source is limited to "academic journal" papers. In order to obtain a wider sample size, this paper uses "digital literacy" as the theme search term, the search date is up to 30 August 2024, and the search results are exported in the custom format of CNKI, including title, author, pubtime, keyword, summary, Chinese Library Classification (CLC), organ, source, and other fields. This paper mainly uses ACCESS database to process the data, and through database screening and cleaning, the valid data of the search results are finally determined to be 4,183 papers.

Analyses and Results

Annual Trend of Paper Publication

These 4,183 papers in CNKI show the overall achievements of the field of digital literacy research in China during the past nearly two decades. As shown in Figure 1, with 2021 as the boundary, the number of published papers maintained a relatively stable growth before, and then ushered in an explosive growth, with the annual growth rates of 2022 and 2023 reaching 120% and 185%, respectively, which signifies that the research on digital literacy has entered into a prosperous period in China. Among these papers, there are 85 papers containing the keyword "teachers' digital literacy", which were first published in 2021, and 107 papers containing the keyword "artificial intelligence", which started in 2017.
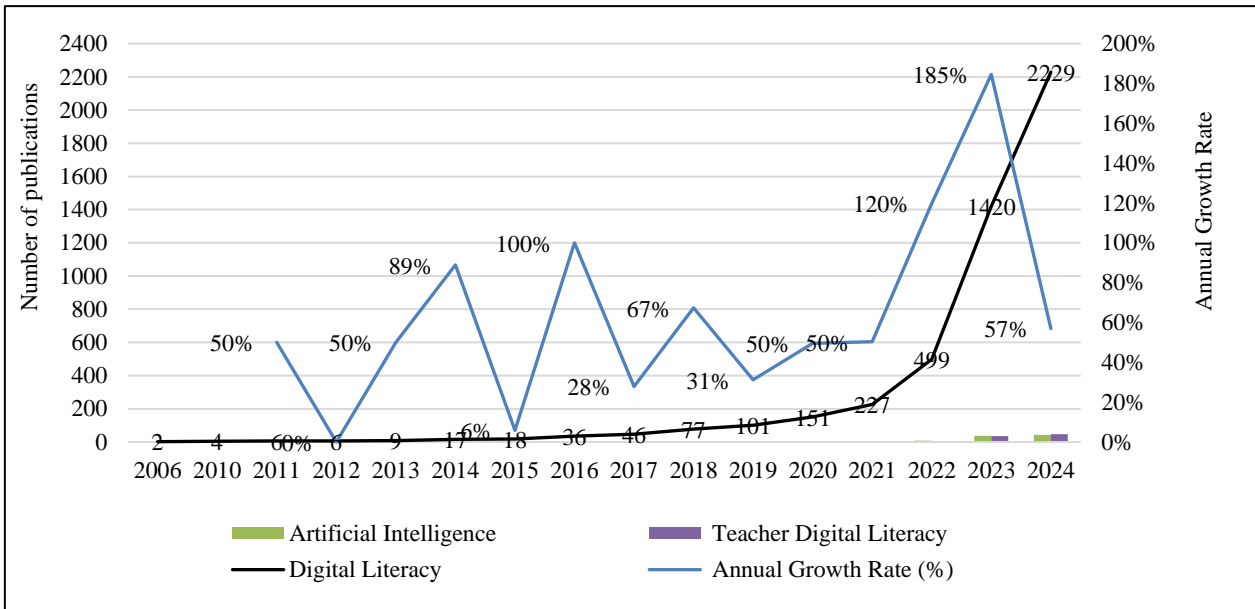

Figure 1. Annual trends of paper publication on digital literacy during 2006-2024.

Analysis of Research Hotspots

High-frequency keywords are often closely related to the research topic. we used the ACCESS database to extract all keywords from 4,183 papers, totalling 6,083 keywords. Among these 4,183 papers, 1,084 papers contain the keyword "digital literacy", while the number of papers containing the keyword "digital technology" is 235. In addition, keywords, such as "digitalisation of education", "teachers' digital literacy", and "artificial intelligence" also appear frequently. The Top 15 keywords and their co-occurrence frequency are listed in Table 1.

Table 1

High-Frequency Keywords in Research Paper on Digital Literacy During 2006-2024

No.	Keyword	Start year	Number of articles	Keyword co-occurrence (Top 4 by frequency from high to low)
1	Digital literacy	2006	1,084	Digital transformation (61) college students (49) digital divide (48) digital rural (38)
2	Digitalization	2015	490	Digital literacy (87) digital technology (36) vocational education (36) educational digitalization (23)
3	Digital economy	2017	249	Rural revitalization (39) digital literacy (31) common prosperity (19) high-quality development (17)

(Table 1 to be continued)

4	Digital technology	2014	235	Digital literacy (27) rural revitalization (26) digital transformation (25) digital rural (13)
5	Rural revitalization	2019	212	Digital rural (68) digital economy (39) digital technology (26) digital literacy (24)
6	Digital rural	2021	198	Rural revitalization (68) digital literacy (38) digital divide (20) rural governance (19)
7	Educational digitalization	2022	281	Digital literacy (56) teachers' digital literacy (29) digital transformation (23) digital technology (12)
8	Digital divide	2014	154	Digital literacy (48) digital rural (20) digital inclusion (18) public libraries (13)
9	Artificial intelligence	2017	107	ChatGPT (25) digital literacy (21) higher education (7) educational digitalization (6)
10	Digital empowerment	2019	88	Rural revitalization (16) digital technology (11) digital rural (10) high-quality development (8)
11	Vocational education	2019	88	Digital transformation (36) digital literacy (19) high-quality development (15) digitalization (7)
12	Digital literacy education	2012	86	Digital literacy (34) university libraries (16) public libraries (11) libraries (7)
13	Teachers' digital literacy	2021	85	Digital transformation (18) educational digitalization (11) digital literacy (9) digital transformation (7)
14	College libraries	2012	80	Digital literacy (30) digital literacy education (16) information literacy (7) university students (6)
15	University students	2012	79	Digital literacy (49) higher education libraries (6) digital literacy education (5) nurturing (4)

Since some of the keywords overlap with each other, we summarise the 6,083 keywords into two core themes: technology and education. The technology theme mainly contains keywords such as digital technology and artificial intelligence, focusing on the fundamental role of digital technology in promoting the digitalisation process in various fields. As shown in Table 1, among the 235 papers containing the keyword digital technology, the co-occurrence of the keyword digital literacy (27 times) is an important theme, whereas among the 107 papers involving AI, the keywords ChatGPT and education digitisation co-occur with AI 25 times and 6 times, respectively. The high co-occurrence of ChatGPT indicates its research heat in the field of AI, while the high co-occurrence of education digitisation indicates its research heat in the field of AI. Digitisation in education, although with a relatively low number of co-occurrences, shows the importance of the application of AI technology in the field of education. The education theme focuses on the applications, challenges, strategies, and trends of digital literacy education at different levels and domains. The keyword digitalisation of education (281 articles) co-occurred with high frequency with digital literacy (56 times), teachers' digital literacy (29 times), digital transformation (23 times), and digital technology (12 times), indicating the strong connectivity relationship between these areas. It is clear that these two core themes are not only concerned with the use of technology in education, but also with the effective integration of technology in educational practice. Although the number of published papers discussing AI and teachers' digital literacy is small, it is clearly a research hotspot in these two years. And the research hotspots of teachers' digital literacy mainly focus on technology integration and teaching innovation, the impact of ChatGPT on teachers' professional development, teachers' digital literacy enhancement strategies, digital support and teachers' development, and teachers' professional development and digital divide. For example, "The Realistic Value and Logical Direction of Digital Technology Empowering Internationalization of Higher Education at Home" (Ren, 2024) discusses the application of digital technology in

the internationalisation of higher education, "The Impact of School Digital Support on Teachers' Digital Literacy" (Feng & Wang, 2024) studies the role and mediating mechanism of school digital support on the role of school digital support on teachers' digital literacy and its mediating mechanism, "Teacher Professional Development Empowered by ChatGPT: Opportunities, Challenges and Path" (Wu et al., 2023) analyses the opportunities and challenges brought by ChatGPT to teachers' professional development from four dimensions: professional concept, knowledge, competence, and sentiment, and "Research on the Path of Practice Oriented Teacher Digital Literacy Improvement—A Multi-case Study Based on International Projects" (Wang & Yan, 2023) proposes a practice path for teachers' digital literacy enhancement based on international case studies, and so on. Together, these studies reflect key issues and solutions in the field of education in the process of digital transformation, from theory to practice, and from technology application to policy development, demonstrating the trend of the research theme of digital literacy education for teachers.

Summary

The Digital Literacy for Teachers 2022 standard released by the Ministry of Education of the People's Republic of China defines in detail five Level 1 dimensions, 13 Level 2 dimensions, and 33 Level 3 dimensions of digital literacy for teachers, which provides a comprehensive framework and guidance for the research and practice of digital literacy for teachers. Teachers' digital literacy has received high attention at the national education policy level, which has led to the rapid development of research in this area. The results of this study show that the research hotspots and trends in the field of digital literacy research are focused on the two major themes of education and technology, which indicates that digital transformation has become an important direction in education that cannot be ignored, and the development and application of technology is a key force in promoting this transformation. The emergence of emerging technologies, such as ChatGPT, further accelerates the change of the education model, and puts forward new digital literacy challenges and requirements for teachers. In the future, with the continuous development of technology, the application of ChatGPT in the field of teachers' digital literacy will be more extensive and in-depth. However, when placed in the overall framework of digital literacy research, the research on ChatGPT and teachers' digital literacy still needs to be strengthened, and future research needs to continue to focus on these hot issues in order to promote the digital transformation of education and the enhancement of teachers' digital literacy.

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