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A bibliometirc analysis of digital education in higher education

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Abstract

In this day and age, with the advancement of technology, it is essential to consider the purpose and vision of the education system, whether it meets the needs of its learners, and the support it receives. The digitalization of society is a systematic process. Through research on digital education in higher education, it is necessary to take a more systematic approach, including the use of technology, the composition of subject and object, and the relationship between them. To further supplement the research methods, questionnaires and other methods should be employed. Additionally, it is important to learn what to learn, how to learn, and how to use various tools to bridge the digital divide, in order to promote talent cultivation in various countries, especially developing countries, and benefit the economic and social development of countries and regions.

Keywords

digital education, higher education, digital divide, research method, bibliometric analysis

Introduction

In this digital age, education has been impacted by the introduction of new variables such as information technology, digitization, and intelligence. This has led to the creation of new relationships, content, and most importantly, a new relationship between subject and object in the field of education(Bond et al., 2018; Marks et al., 2021). Therefore, it is essential to focus on digital education, particularly in higher education, to address the relationship between deep thinking, fragmented information, lifelong learning, information entertainment, and the value of professional knowledge. It is also important to consider how to combine digitalization with higher education, as well as the transformation and transformation of digitalization and education. Thus, it is necessary to conduct research in this area.

Methodology

By utilizing bibliometric and statistical methods, this article aims to gain a more comprehensive understanding of the current research status on tourism poverty alleviation in China. The external features of the literature, such as authors, journals, disciplines, and vocabulary, are analyzed to reflect the research field, hotspots, and focuses of the discipline. Co-word analysis is a widely used approach to analyze the relationship between topics in a given field. This method quantifies the number of documents that contain two keywords by constructing a co-word matrix, correlation matrix, and dissimilarity matrix. Additionally, multivariate statistics, social network analysis, and visualization operations are also employed to gain further insights. In short, co-

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word analysis is a powerful tool for understanding and visualizing the interactions between keywords in the scientific field(Muñoz-Leiva et al., 2012; Rojas-Lamorena et al., 2022). Based on this, keyword social network analysis charts at different stages are drawn and extracted, in order to better understand the research hotspots and development trends related to digital education. Co-citation and co-authorshipship analysis have also been used as the analysis methods by Utkarsh and Sigala(Utkarsh & Sigala, 2021). Additionally, a timeline analysis, coupled with a burstness test, can be utilized to showcase academic developments over a specific duration(Li & Xu, 2021).Citespace, a computer tool created with the help of relevant research methods, is one such example(Chen, 2006).

On April 22, 2023, a keyword-based search was conducted using the terms "digital techniques" and "higher education OR university * OR college *" in the Web of Science database according to Core-collection. The search was limited to English-language journal papers, resulting in 748 papers. After a careful review of the titles and abstracts, 521 papers were found to meet the criteria. Metrology analysis of the chosen literature was then conducted using Citespace.

Results and Discussion

Bibliometric Analysis

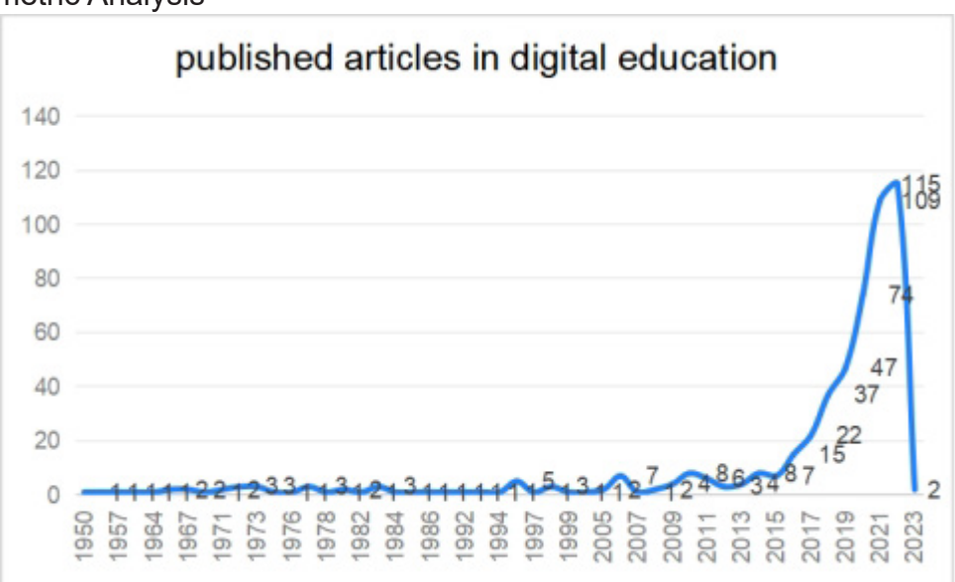

Fig1 published articles related to digital education

Published articles

Prior to 2015, this field of research was fairly limited and has yet to be fully recognized in terms of its importance. However, with the emergence of the digital economy and its vast promotion from countries such as the US and Germany, the area of education has seen rapid growth and expansion since 2015. This topic has become of global interest, particularly since the outbreak of COVID-19.



Fig2 author co-work analysis

Analyzing co-authorships revealed that some research teams have developed a deeper collaboration in this field, such as the Gullen-gamez team, Almaiah team, Bedenller team, and so on. Nevertheless, the author co-operation network in the entire field still appears relatively loose, thus necessitating further strengthening of team cooperation and international collaboration to facilitate knowledge transfer.



Fig3 published articles related to countries

According to the national statistics of the author's research institution, the top 10 high-yield countries are the USA, England, Spain, and People's Republic of China, Germany, Australia, India, Russia, Norway, and South Africa, with the majority of them being developed nations. This also signifies that the level of maturity and

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the difficulty of digital transformation, especially in higher education, and particularly in developing countries, is limited(Marks et al., 2021).

Keyword analysis

Table summary of Top 25 high frequency keywords

Rank	Freq	Label	Year
1	164	higher education	2006
2	43	technology	2008
3	35	university	2009
4	33	digital transformation	2019
5	26	performance	2013
6	26	students	2017
7	25	digital literacy	2011
8	18	college students	2006
9	18	skills	2020
10	17	impact	2014
11	15	online	2011
12	15	digital learning	2019
13	15	model	2018
14	14	perceptions	2012
15	14	digital competence	2016
16	13	ict	2015
17	13	digital divide	2006
18	13	information	2020
19	13	digital technologies	2018
20	12	framework	2020
21	12	digital technology	2020
22	11	literacy	2010
23	11	social media	2016
24	10	acceptance	2014
25	10	information technology	2014

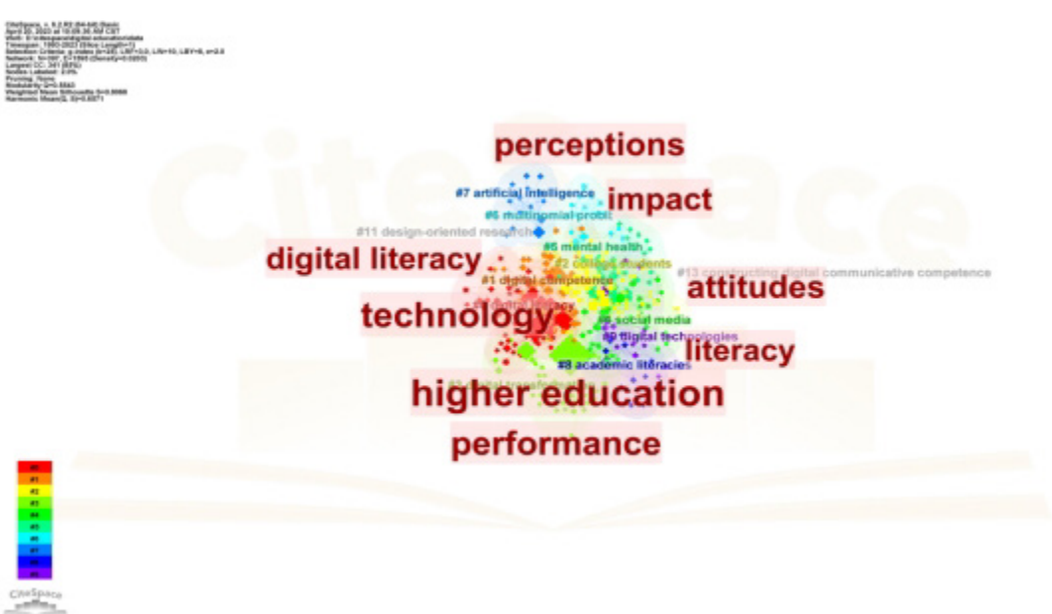

Fig4 co-word analysis with clusters

By analyzing the word frequency and co-word network, as well as taking into account the dividing line of

2015 as a reference, it was discovered that the keywords used prior to 2015 mainly revolved around the topics of impact, acceptance, information technology, performance, perceptions, digital literacy, online, literacy, university, technology, higher education, college students, and digital divide, which mainly focused on the application of digitization of texts and digital divide in higher education. After 2015, however, the focus shifted to skills, information, framework, digital technology, digital transformation, digital learning, model, digital technologies, students, digital competence, social media, and ICT, which implies a shift in the direction of research, from simply utilizing digital technologies and capabilities to a more systematic approach in order to better drive innovation in educational organizations and reconstruct the educational ecosystems.

Timeline analysis

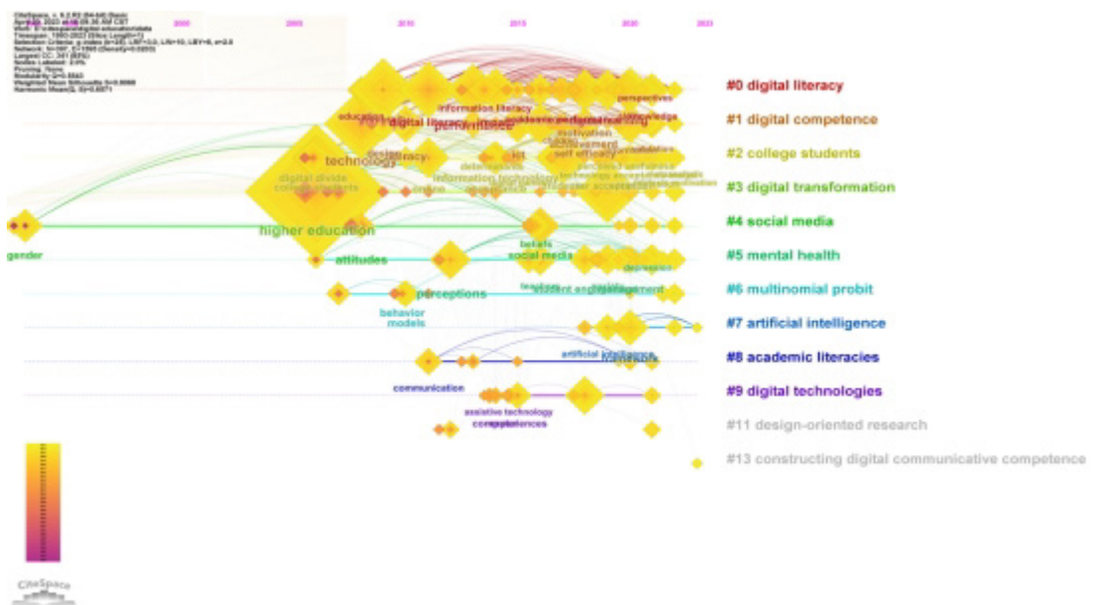

Fig5 timeline of research in digital education

As illustrated in Figure 5, various keywords are categorized into 12 different sub-regions. To gain a better understanding of their dynamic development trends, this section provides a timeline of their occurrences. The longest-occurring category is Cluster 5, with most keywords emerging after 2005.

Summary of the Findings

According to the analysis, research in this field centers around the following clusters:

Cluster 1 Digital literacy is comprised of digital technology, information literacy, university personnel, digital marketing, digital learning, case study research, digital transformation, mixed methods, and the one-child policy.

Cluster 2 is related to digital competence, comprising of supply chains, institutional factors, interactive media, and experience. These elements include experience, debate, model, reality, and the internet.

Cluster 3 is related to social media, such as computer anxiety, perceived usefulness, communication technology, acceptance model, digital divide, critical analysis, technological education, technology appropriation, and graduate education.

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Cluster 4 is associated with digital transformation, encompassing digital technologies, social institutions, managing change, and strategic management, as well as digital libraries, management strategy, business planning, strategic change, and education institutions.

Cluster 5 is related to social media, exploring topics such as gender differences, mediation analysis, social influence, college student drinking, bibliometrics, higher education, curriculum, interdisciplinary, and learning strategies.

Cluster 6 is related to mental health, such as video games, adolescent health, internet addiction disorder, and addictive behavior; as well as online learning, remote learning, social capital, the COVID-19 era, and virtual reality.

Cluster 7 is related to a categorical dependent variable, connected to student persistence, success, and the use of multinomial logit and multinomial probit. It also involves student health services, mobile phone, web-based intervention, illicit drug use, and harm reduction.

Cluster 8 is related to Artificial Intelligence, such as Augmented Reality, Machine Learning, Web-based Learning, Making Trial, Deep Learning, Intrusion Detection System, Deep Neural Network, Security Institutions, and Hyper parameter Tuning.

Cluster 9 is related to digital literacies, such as academic literacies, learning technology, textual practice, university teachers' online leadership discourse, digital multimodal discourse perspective, university leadership communication, social semiotics, and multimodal analysis.

Cluster 10 is related to digital literacies, such as academic literacies, learning technology, textual practice, university teachers and online leadership discourse, as well as digital multimodal discourse perspective, university leadership communication, social semiotics and multimodal analysis.

Cluster 11 focuses on activating digital learning resources, examining learning objects, performing requirements engineering, undertaking design-oriented research, and utilizing large-scale use.

Cluster 12 relates to questionnaire development, including constructing digital communicative competence; constructing validity and reliability; validating questionnaires; and higher education.

Conclusion

With the advancement of technology and the development of society, the purpose and goals of the education system, whether it meets the requirements of its learners, and the necessary support are two important topics (Butler et al., 2018). To bring digitalization to the entire society, it has to be viewed from a more comprehensive perspective, including the utilization of technology, the composition of subjects and objects (such as existing teachers, educational institutions, students and other stakeholders who may need to include machines and intelligent machines), the relationship between subjects and objects (which increases the connection between intelligent machines and existing subjects and objects, as well as network issues), and other aspects that need to be deeply examined. The research methods must be supplemented from the original questionnaire survey and other methods. Moreover, it is essential to further clarify what to learn, how to learn, and how to use various tools to promote talent cultivation in different countries, particularly in developing countries, to promote the economic and social growth of the country and region.

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