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Research Hotspots and Trends of Educational Ethics of Artificial Intelligence in China

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Abstract: The ethical issues in the application of artificial intelligence education have attracted increasing attention. This paper takes 205 literatures collected in CNKI database as the research object, analyzes the institutions and keywords by using CiteSpace, an information visualization software, and reveals the research hotspots and development trends of artificial intelligence education ethics in China. The results show that the research hotspots of AI educational ethics in
China focus on AI, educational ethics, education, higher education, AI era, practical path, etc. The research has a long history, but it is still in the primary stage, so researchers need to conduct more in-depth and detailed research in this field. For this reason, the article gives further summary and thinking, with a view to providing reference for the in-depth study of AI education ethics.

Keywords: Artificial intelligence, Education; Ethics, CiteSpace, Visualization analysis

1. Introduction

In March 2019, the Ministry of Education issued the Key Points of Education Informatization and Network Security in 2019, which clearly pointed out that: "It is required to open artificial intelligence related courses in primary and secondary schools and promote the in-depth application of new technologies such as big data, virtual reality and artificial intelligence in education and teaching." (Zhang Mian,2020). However, with the continuous breakthrough of artificial intelligence technologies such as pattern recognition and machine learning, the application of artificial intelligence in education is also faced with a series of ethical issues such as data security, privacy protection, and the role transformation of teachers and students. This paper aims to explore the research hotspots and trends of AI education ethics in China, in order to provide reference for further research on AI education ethics.

2. Data Sources and Processing

This study mainly analyzes the keyword frequency, clustering, and hot spots of the literature related to educational AI ethics in China in recent years, and searches on CNKI database. Through CNKI's "Advanced Search", the topics of "Artificial Intelligence", "Education" and "Ethics" were selected for literature search. By June 25th, 2021, 314 literatures had been retrieved, and qualified literatures were screened out through manual filtering. Finally, 205 literatures were selected for visual analysis, including journals, dissertations and conference papers.

CiteSpace visual analysis tool used in this study is an information visualization tool developed by Professor Chen Chaomei of Dressayre University, USA, which is suitable for multivariate, timesharing and dynamic complex network analysis (Wang Juan et al.2016). Export 205 documents to Refworks format, open CiteSpace software, click the "CNKI" label in "Import/Export" for format conversion, and use the converted data for analysis. The time span is 2000 ~ 2021, and the interval is 5

years, respectively, to analyze institutions and keywords. CiteSpace provides three views, namely, cluster graph, timeline graph and time zone graph. This paper presents the final analysis map by static clustering and visualization of the whole network.

3. Data analysis and discussion

The purpose of this paper is to analyze the current research situation of AI education ethics in China, draw the amount of relevant documents published in recent years by Excel, investigate the research results of the integration of AI, education and ethics, analyze the high-yield institutions of AI education ethics by CiteSpace, analyze the research hotspots and trends of AI education ethics by keyword cooccurrence, clustering and time series diagram, and reveal the research frontier and direction of AI education from an ethical perspective.

3.1 Time distribution map of AI education ethics research

According to the statistics of 205 articles, as shown in Figure 1, all the articles were published in the last five years. From the quantitative trend, the number of articles published increased year by year, reaching the peak in 2020. However, as the statistical time ended in June 2021, the number of articles published in 2021 was still considerable, and the overall research showed an upward trend. In April, 2021, Huawei, which has invested more than five years in the field of automatic algorithms, announced that its driverless technology has reached L4 level, bringing another breakthrough to AI. Under the guidance of national policies in the future, the application of artificial intelligence technology in the field of education will only be more and more. While the educational reform caused by technology brings us numerous conveniences, it is bound to also cause ethical, moral and even legal problems. In the future, more and more scholars will begin to pay attention to and study the ethical problems and ethical governance in this field.

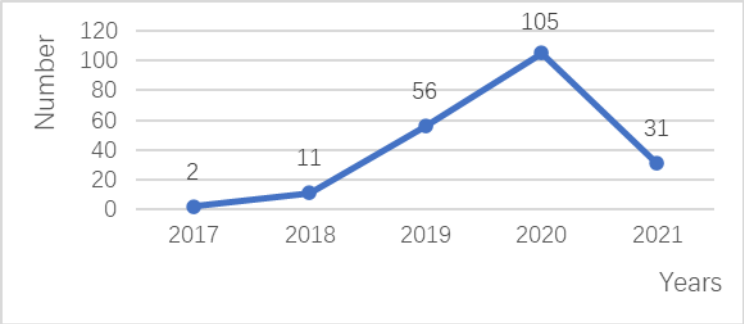

Figure 1. Literature statistics of educational ethics of artificial intelligence in China.

3.2 Figures and Table Spatial distribution map of AI education ethics research

In order to find out the core academic groups and institutions of AI educational ethics research in China, this study counted 205 research institutions of literature, and through CiteSpace co-occurrence analysis, we got a co-occurrence map of institutions in AI educational ethics research field with 61 nodes, and further sorted out the scale of articles issued by the core institutions with a starting volume greater than or equal to 2, as shown in Table 1. As shown in Table 1, Shanghai Education Press Headquarters, China Academy of Science and Technology Development Strategy, Jiangnan University School of Education, and East Normal University Department of Education are the institutions with the largest number of publications, and the publication year of these institutions is earlier than that of other institutions, which shows that these institutions are rich and mature in the research of AI education ethics, and they are representative institutions in this field. The China Academy of Science and Technology Development Strategy, as a public institution directly under the Ministry of Science and Technology, and the Education Press Headquarters directly under the Shanghai Municipal Education Commission, are enough to show that the state attaches great importance to the ethical research of it. In addition, on the whole, the research institutions in this field are mostly the education departments of universities and

Marxist colleges, which also shows that this research is an interdisciplinary field of education and Marxism.

Table 1. *Core institutions in the research field of artificial intelligence education ethics*

Serial number	Quantity of documents issued	Starting year of publication	Organization
1	5	2000	Shanghai Education Press Head Office
2	5	2000	China Academy of Science and Technology Development Strategy
3	3	2000	Jiangnan university education college east China normal university education department
4	3	2021	Capital Normal University
5	3	2018	East China Normal University Education Department
6	2	2019	Beijing Normal University Wisdom Learning Research Institute
7	2	2020	Jiangnan University Tian Jiabing College of Educational Sciences
8	2	2018	Marxism College of Shanghai Normal University
9	2	2020	Guizhou Normal University Education College
10	2	2020	school of journalism and communication
11	2	2020	Northeast normal university education department
12	2	2018	Marxism College of South China Normal University South China Normal University Value Education Research and Development Center
13	2	2020	Qufu Normal University Media College
14	2	2020	Yunnan University Institute of Higher Education Yunnan university Marxism college
15	2	2019	Communication University of China
16	2	2020	Lanzhou University Media College Northwest Normal University Media College

3.3 Research focus of AI education ethics

From the perspective of knowledge theory, keywords with high centrality and frequency represent the common concerns of researchers, that is, research hotspots. Centrality, as a measure of the power of a node, reflects its importance in the network. The higher the co-occurrence frequency of keywords, the higher the point centrality, indicating that nodes are more important in this field(Wang Juan et al.2016). As shown in Table 2, keywords with high frequency in domestic research literature include artificial intelligence, ethics, intelligent age, artificial intelligence education, education, higher education, intelligent education, etc., which reflects the focus and migration of ethical research on AI education in China in the past twenty years.

Table 2. *Co-occurrence frequency, centrality and year of keywords*

Serial number	Frequency	Centrality	Age	Keyword	Serial number	Frequency	Centrality	Age	Keyword
1	119	0.85	2017	artificial intelligence	12	5	0.12	2020	Educational ethics
2	11	0.31	2018	ethics	13	5	0.03	2020	teacher
3	10	0.14	2000	Intelligent age	14	4	0.19	2018	Ethical risk
4	9	0.13	2017	Artificial intelligence education	15	4	0.04	2018	Wisdom Education
5	9	0.36	2018	education	16	4	0.35	2018	Educational big data
6	8	0.12	2018	higher education	17	4	0.22	2019	Artificial intelligence education
7	7	0.27	2019	Intelligent education	18	4	0.06	2019	transformation
8	5	0.01	2000	difficult position	19	4	0.03	2020	teacher-student relationship
9	5	0.02	2000	Risk management	20	4	0.06	2020	ideological and political education
10	5	0.13	2019	big data	21	4	0.07	2020	Philosophy of technology
11	5	0.12	2019	Artificial intelligence era	22	4	0.06	2020	Technical ethics

Through the cluster analysis of key words, as shown in Figure 2, there are 11 hot research topics such as artificial intelligence, educational ethics, education, higher education, artificial intelligence era, practice path, artificial intelligence education, reform, ideological and political education in curriculum, practice path and big data. The number in front of the keyword represents the cluster number. The smaller the cluster number, the more keywords it contains. The clustering module value (Q value) in the clustering result is 0.7235>0.3, which means that the clustering structure is significant; The average contour value (S value) of clustering is 0.9164>0.7, which means that clustering is very convincing.

Figure 2. Cluster Atlas of Ethical Key Words of Artificial Intelligence Education

3.4 Research trend of artificial intelligence education ethics

On the basis of the cluster diagram, this study counted the time series diagram of the frontier keywords of AI education ethics in China by time segments (every five years), as shown in Figure 3. Around 1999-2000, the concept of the intelligent age began to appear. At that time, some scholars had already paid attention to the ethical issues of educational data, as well as the risks, dilemmas and practical paths faced when entering the intelligent age. With the continuous progress and development of science and technology, the ethical research of artificial intelligence educational concern is booming. No matter from the technology itself, the whole educational ecology, or a single teaching mode, the ethical problems brought about will be studied and concerned in the future.

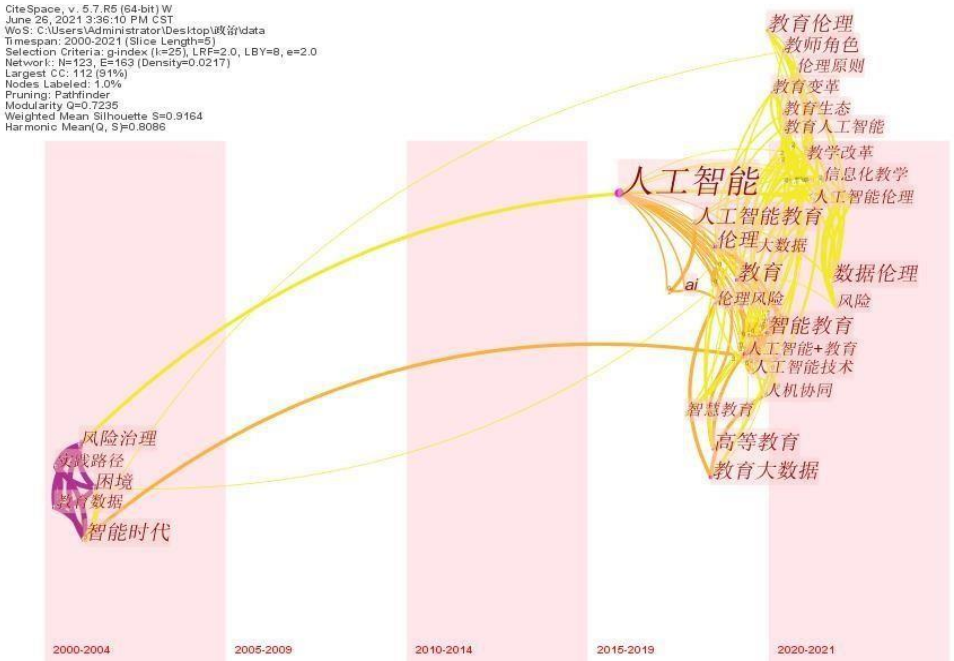

Figure 3. Time series diagram of keywords at the forefront of artificial intelligence education ethics

4. Conclusion and Thinking

4.1 Research conclusions

In this study, CiteSpace software is used to analyze and visualize the atlas and related data generated by the literature on domestic AI education ethics from 2017 to 2021 in CNKI database at different levels, and the following conclusions are drawn:

- The time distribution spectrum shows that in recent years, the number of articles published on the ethics of AI education in China is on the rise, which shows that more and more scholars are beginning to focus on ethical issues in it, and they also expect that future research in this field will attract more people's attention and thinking.
- The spatial distribution map shows that under the leadership of the National Institute of Science and Technology Development Strategy, there are many institutions that study the educational ethics of artificial intelligence, and they are also the core institutions in this field. However, because the research is in the primary stage, the number of articles published by relevant institutions is small. In the future, it is necessary to strengthen the research in this field, as well as the cooperation and integration among education, philosophy, science and other fields, to establish a community and a long-term development mechanism, and to promote a virtuous circle of AI education ethics research.
- The keyword co-occurrence and cluster map show that the research hotspots in the field of AI educational ethics focus on AI, educational ethics, education, higher education, AI era, practice path, AI education, reform, curriculum ideological and political education, practice path and big data. The research topics are mainly distributed in practice path, reform, curriculum ideological and political education, big data and so on, which also reflects that the research is dominated by national policies. Under the guidance of educational and teaching reform and deepening the reform and innovation of ideological and political theory courses in schools in the new era, the research focuses on constructing ethical principles such as engineering ethics, technical ethics and data ethics in education, and exploring the ethical practice path of the application of artificial intelligence education, aiming at cultivating people's ethical consciousness.
- The time sequence diagram of research frontier shows that the frontier of AI education ethics in China is embodied in education ecology, ethical principles, teacher's role, education reform, information-based teaching, data ethics, man-machine cooperation, and intelligent education. This reflects the characteristics of strong interdisciplinary and interdisciplinary integration, but the research scope is large, the research points are scattered, and there is a lack of specific research direction. Therefore, researchers need to conduct more in-depth and detailed research in this field.

4.2 Research and thinking

While AI brings us powerful data integration and analysis ability, it also brings many educational ethical problems and risks. In 2019, the European Commission published the Ethical Guidelines for Artificial Intelligence, which constructs an ethical framework from seven aspects to ensure that artificial intelligence is safe and reliable enough (Zawacki et al. 2019). The construction of the ethical principles of AI education can provide reference ethical norms for us in the research and development enterprises, deployment schools, and government supervision of AI education products (Shen et al. 2019).

Based on the existing research, the following three suggestions are put forward for the future application and development of AI in education: First of all, the existing AI education mostly stays in the field of knowledge and skills, ignoring the field of emotion and ethics. Therefore, the application of AI education should attach importance to emotional experience, people-oriented, student-centered, and strengthen ethical education. Secondly, at present, AI products are constantly emerging, but most of them are still in the stage of computational intelligence, not towards the stage of cognitive intelligence, and the technology is not mature enough to solve all the problems existing in the current teaching. In the future, it is necessary to further improve artificial intelligence technology, promote the deep integration of education and artificial intelligence, so that it products not only have "intelligence", but also pay more attention to "emotion". Finally, as "man-machine teaching" becomes a regular form of education, the role of teachers will change dramatically. AI will focus on "teaching" and teachers will

focus on "education". Of course, the efforts of individual researchers alone are not enough. There is also a need to continuously increase the importance of the relevant departments of education and promote the participation of more teachers in relevant research. In addition, how to carry out teacher education and teaching innovation, so that machines and teachers cooperate in education, to achieve talent training in the era of AI, will become the focus of future research.

In the final analysis, education is human education. The essence of artificial intelligence is still a tool and a technology. Its application in the field of education cannot change the nature and purpose of education (Li Xiaoyan et al.2021). Therefore, in the application of AI education, we should give full play to the subjectivity of people, take the all-round development of people as the goal, use artificial intelligence technology to solve educational problems, and promote the development and innovation of education.

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