ISSN 2616-7433 Vol. 6, Issue 7: 126-135, DOI: 10.25236/FSST.2024.060718

Visualized Analysis of the Impact of AI Technology on Learning Based on CiteSpace

Sinuo Sun*

School of Information and Science Technology, Ynnan Normal University, Kunming, 650000, China
**Corresponding author*

Abstract: *The purpose of this review is to explore the impact of AI technology on learning, and through a comprehensive analysis of the relevant literature, summarize and summarize the main research directions in this field. In this study, the relevant literature of "Artificial Intelligence technology and educational learning" in the CNKI database was used as the data source, and bibliometric analysis and content analysis were used to map the knowledge of researchers, institutions and keywords to identify major topics, key researchers and research hotspots. Combined with Excel software statistics, the journal bar chart and the annual document volume line chart. Through the analysis of the atlas one by one, the following conclusions are drawn: the research journals on this topic can be roughly divided into three categories: comprehensive education journals, educational technology journals and higher education journals; since 2016, the annual publication volume has increased rapidly; there are many researchers and institutions, but the cooperation is not close enough; "artificial intelligence", "intelligent education", "man-machine collaboration" are the current research hotspots, "study analysis" and "influencing factors" are the future research trends. The challenge of educational AI in the future lies in how to deeply integrate artificial intelligence technology, not only stay in the field of knowledge and skills, but also pay more attention to the field of "emotion".*

Keywords: *CiteSpace; artificial intelligence technology; learning; knowledge map; intelligent education; visual analysis*

1. Foreword

With the rapid development of science and technology, artificial intelligence technology is increasingly becoming a key driving force in various fields. In the field of education, artificial intelligence technology is also widely used, providing rich resources for learners and educators. First of all, the intelligent education system can provide personalized learning content and guidance according to students' personalized needs and learning style, and use the recommendation algorithm to select the optimal learning path suitable for learners, support students to choose learning according to their needs, and meet their personalized learning needs[1]. Secondly, artificial intelligence technology can also realize intelligent assisted teaching and guided learning. Teachers can use tools such as virtual teacher assistants, intelligent teaching assistants and virtual laboratories to provide a more interactive and practical learning experience. In addition, AI can also be used for educational assessment and student monitoring. Through data analysis and machine learning algorithms, students' learning progress, ability level and learning habits can be tracked and evaluated. Such information can help educators understand students' learning needs, timely provide personalized support and adjust teaching strategies[2].

Research on the influence of AI technology on learning is of great significance in the field of education. Personalized learning helps to stimulate students' interest and motivation in learning. Data analysis provides insight into learners 'cognition, emotions and needs, thus improving educational practice and improving learners' academic performance and learning experience. Secondly, the impact research on learning can reveal the impact of AI technology on learning methods and strategies. Researchers can explore the optimal teaching models and strategies by comparing the effects of different teaching methods and AI applications, which can help provide a scientific basis for educational decision makers and improve education and practice. Finally, research on the impact of learning can also provide guidance for the development of AI technologies, and researchers can provide more accurate guidance for the design and development of AI technologies.

To sum up, the rapid development of AI technology in the field of education provides a broad application prospect for personalized learning, intelligent assisted teaching and educational evaluation.

ISSN 2616-7433 Vol. 6, Issue 7: 126-135, DOI: 10.25236/FSST.2024.060718

In-depth study of the impact on learning can help us better understand the role and mechanism of AI technology in education, so as to continuously optimize educational practice and improve the learning effect and achievement of learners.

2. Research Design

This study focuses on the analysis of AI technology and educational learning, including the study of spatial otemporal distribution, keyword clustering, keyword timeline, etc. In this study, CiteSpace software was used to generate various knowledge maps, combined with the statistical functions of Excel software, analyzed all kinds of maps generated by the retrieved literature, sorted out the impact of artificial intelligence technology on learning in detail, and tried to summarize the research hotspots and trends, and finally drew conclusions and enlightenment.

2.1. Data collection and Method

The data for this study were selected from the CNKI China full-text database. In order to ensure the accuracy of the comprehensive and authenticity, and research data select advanced retrieval, mixed use of boolean operation, respectively to "artificial intelligence * learning", "intelligent technology * learning", "technology * learning" as the theme and keywords retrieval, through secondary screening, artificial browsing with the literature correlation is not high, finally get effective data 309, as a sample of this study.

2.2. Research Steps

First of all, the selected literature will be retrieved from CNKI and exported to 'Refworks' format, and then the histogram of literature source journals will be drawn in Excel; in addition, the literature will be exported to '.xsl' format, and then the trend of annual publication volume will be drawn in Excel; then the data obtained will be imported into CiteSpace to generate the knowledge map. Annual trend chart of the number of articles issued; and then use the bibliometric visualisation tool CiteSpace software to pre-process the screened literature, and then import the obtained data into CiteSpace to run to generate a knowledge map, set the parameters before running, the time period is 2001-2023, the time slice is set to 1 year, select the corresponding node type, generate various types of maps, and adjust the picture to make it present the expression content clearly..The knowledge graph is sorted out and analyzed in detail, and the current research hotspot is analyzed according to the graph, combined with the conclusions and enlightenment of this study.

3. Analysis of The Basic Information of The Research Literature

3.1. Statistics of Literature Sources and Source Journals

The category of published journals refers to the type of journals with published papers. The research quality and level of artificial intelligence technology and educational learning can be roughly revealed through the category of published journals and the published status [3]. The author made the quantitative statistics of the literature source journals in the selected study sample, and obtained the top ten journals, as shown in Figure 1.

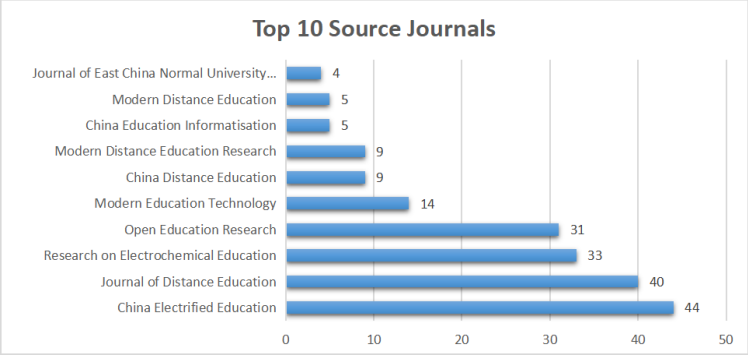

Figure 1: Source journal T op 10

ISSN 2616-7433 Vol. 6, Issue 7: 126-135, DOI: 10.25236/FSST.2024.060718

Among all the journals published in artificial intelligence technology and learning, the top five journals in the number of journals with published articles in the past 20 years are China Audio-visual Education, Distance Education Journal, Audio-visual Education Research, Open Education Research and Modern Education Technology. Among them, "China Audio-visual Education" published the largest number of articles, reaching 44, and "Distance Education Magazine", which ranked second, published 40 articles, and 4 journals with more than 30 articles. As can be seen from the figure, the top 10 journals in the number of articles on this topic are all core journals in the field of educational technology, and the quality of the journals is above high. In addition, the journals of artificial intelligence technology and educational learning and research can be roughly divided into three categories, namely, comprehensive education journals, educational technology journals and higher education journals.

3.2. Annual Statistics of Literature Publications

To some extent, the annual distribution of literature can reflect the overall level and development speed of research results in a certain field. In the study, 309 retrieved articles were exported to Excel for statistical analysis, and the screening fields and count items were Year-year, and the annual statistical map of literature publication was obtained, as shown in Figure 2:Can be seen from the figure, the selected and artificial intelligence technology and learning topics related 309 literature, the field of research after 2001, specific can be divided into two stages: (1) bud development period (2011-2016), this period in addition to 2012 post 4, the rest of the time post less than 4 a year, a total of 22 articles. This stage of research mainly focuses on the preliminary exploration of the relationship between key technologies and learning in educational technology; (2) In the period of rapid growth (2016-2022), the number of publications increased rapidly in this stage. Although showing a slight downward trend from 2019 to 2020, the number of publications was more than 20 each year, totaling 277 articles.2016 is called the "first year of artificial intelligence"[4], and all fields of society once again attach importance to the development of AI[5]. In the past five years, relevant research has maintained a rapid growth trend, indicating that the application of AI in the fields of learning and education is receiving more and more attention, and the update speed is also faster and faster. This reflects the increasing influence of artificial intelligence technology in the field of education and learning.

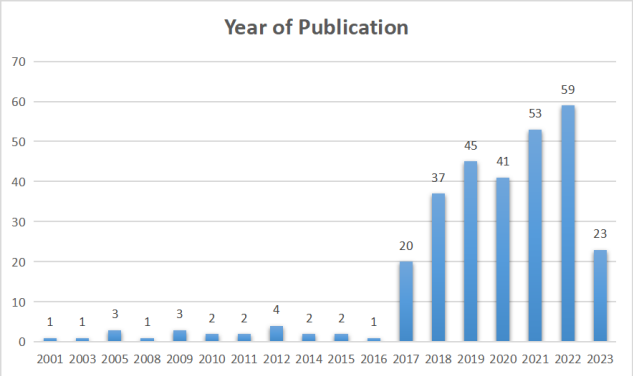

Figure 2: Statistical chart of annual literature publications

3.3. Study the Spatial Distribution Map

3.3.1. Study Authors and Collaborative Network Analysis

The analysis of the study authors reveals the contribution degree of the researchers in a certain research field and the cooperation between the researchers [6]. To better reflect the core authors and associations in the field of artificial intelligence, 309 papers underwent a visual analysis of the author cooperative atlas, as shown in Figure 3. The number of core authors was also counted, and the top five are shown in Table 1.

The node sizes in Figure 3 represent the number of papers published by the author, and the connection represent the collaboration [7]. It can be seen from the graph results that there are relatively few groups of researchers with network distribution, and the multi-person researcher cooperation network with close research mainly includes five groups, with more connections and close cooperation, most of which are three research groups. Through data analysis, it can be found that the cooperation density between authors' nodes is low, only 0.0059, indicating that the researchers in related fields are relatively scattered and there is no cooperative relationship in a real sense.

ISSN 2616-7433 Vol. 6, Issue 7: 126-135, DOI: 10.25236/FSST.2024.060718

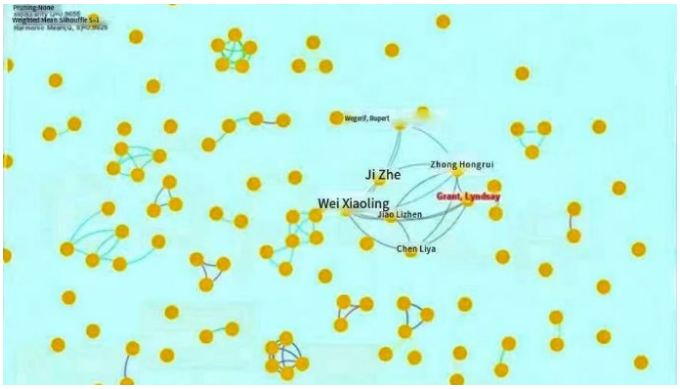

Figure 3: Study author and partnership network map

Table 1: Top 5

Order Number	Author	Number of posts
1	Gu Xiaoqing	10
2	Wang Yiyan	7
3	Zheng Yonghe	7
4	Zhu Zhiting	5
5	Li Shijin	5

As can be seen from Table 1 of the ranking number of publications, Scholar Gu Xiaoqing published the most articles and contributed the most to the research in this field. At the same time, from 2001 to June 2023, there were only five authors with more than five articles, namely: Gu Xiaoqing, Wang Yiyan, Zheng Yonghe, Zhu Zhiting and Li Shijin. Therefore, there are many researchers in the field of artificial intelligence technology and education and learning, however, from the perspective of publications per capita, there are few high-yielding authors in domestic journals, indicating that the research depth in this field is lacking.

3.3.2. Research Institutions and Cooperative Network Analysis

In order to present the direction and results of the cooperation among the research institutions, the research institutions were mined, analyzed and visually presented, as shown in Figure 4. Statistics were also performed for high-yield institutions, as shown in Table 2.

In the organization cooperation map, each node represents the number of papers of the organization, and the connection represents the mutual cooperation between organizations. The more cooperation, the higher the degree of cooperation of the organization with other organizations[8]. From the perspective of the distribution of publishing institutions, the research institutions of "artificial intelligence technology and education learning" are mainly divided into three categories: the first category is universities, such as East China Normal University, Beijing Normal University, etc.; the second category is engineering and technology laboratories. Such as National Engineering Laboratory of Intelligent Technology and Application of Internet Education of Beijing Normal University, the third category is research institute, such as Intelligent Learning Institute of Beijing Normal University. Above research units constitute the "artificial intelligence technology and education learning" the main academic research, but overall, these research institutions are relatively scattered, cooperation is not close enough, the internal independent research situation is more, not stable high yield cooperation group, "artificial intelligence technology and education learning" researchers and institutions in the field of research should further strengthen the cooperation between each other, common high quality to promote the development of research in the field.

ISSN 2616-7433 Vol. 6, Issue 7: 126-135, DOI: 10.25236/FSST.2024.060718

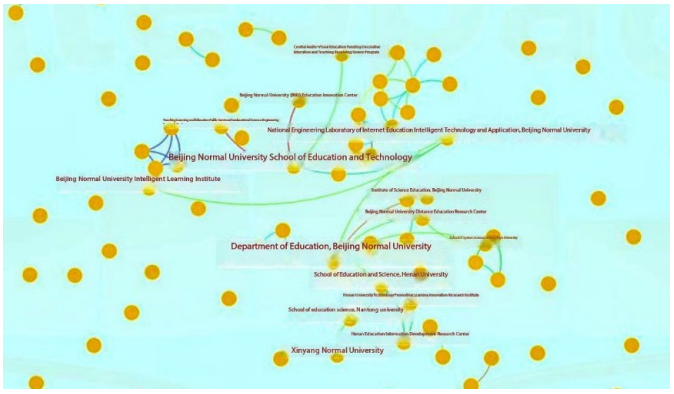

Figure 4: Map of the co-occurrence and cooperative network of research institutions

1Table 2: Ranking of institutional publications

Order Number	Number of posts	Document organization
1	16	Department of Education, Beijing Normal University
2	15	School of Educational Information Technology, South China Normal University
3	9	School of Information Science and Technology, Northeast Normal University
4	8	Department of Education Information Technology, Department of Education, East China Normal University
5	7	Department of Education, Beijing Normal University

4. Analysis of The Research Hotspots

Keywords are the expression of the core and refined content of the paper, and the research hot spots can be detected through keyword and frequency analysis[9]. Keywords reflect the relationship between various topics to be expressed in the literature, and are the core summary of the article. Analysis of keywords is conducive to the hot spots in this field.

4.1. Keyword Co-occurrence Map Analysis

When using CiteSpace 6.2.R4 software to draw keyword co-occurrence knowledge graph, its parameters are set as: (1) the time range from 2001 to 2023; (2) taking 1 year as the time period; (3) node type select keywords, and other options adopt default values. In the constructed keyword co-occurrence knowledge graph, there are 246 nodes and 463 connections, and the overall density of the network is 0.0154. As shown in Figure 5. Through CiteSpace software calculation and sorting out the year and centrality of the first occurrence frequency, the co-occurrence statistics of the top 10 keywords related to "artificial intelligence technology and learning" from 2001 to 2023 were made, as shown in Table 3.

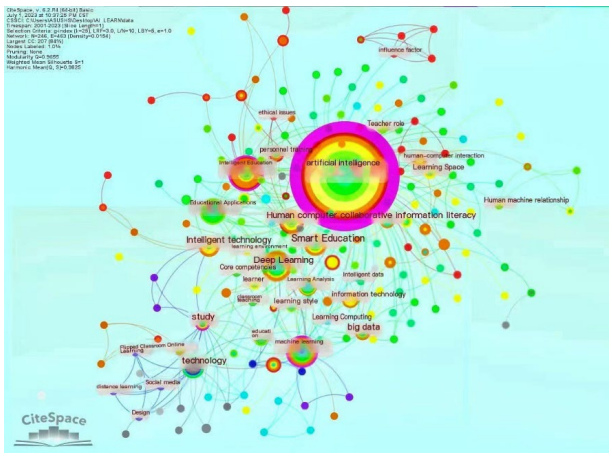

Figure 5: Keyword co-occurrence map

ISSN 2616-7433 Vol. 6, Issue 7: 126-135, DOI: 10.25236/FSST.2024.060718

Table 3: Key word frequency and centrality

Order Number	Word frequenc	Centrality	a Particular Year	Keyword
1	155	1.14	2003	artificial intelligence
2	26	0.13	2017	Intelligent education
3	19	0.06	2018	man-machine coordination
4	18	0.19	2005	study
5	17	0.02	2017	Wisdom education
6	16	0.03	2015	deep learning
7	15	0.17	2014	machine learning
8	14	0.02	2009	Education application
9	12	0.01	2005	technology
10	10	0.08	2014	intellectual technology

The size of each node in the map represents the number of occurrences of the word, and the circle becomes larger as the number of occurrences increases. From the data results, we know that there are close links between the nodes, and few individual nodes appear. As can be seen from the table, the research on artificial intelligence, intelligent education, human-machine collaboration, learning and intelligent education is relatively active. According to the centrality order, the top five are: artificial intelligence, learning, machine learning, intelligent education, and intelligent technology, which shows that these aspects are the research hotspots of researchers, and they play an important role in connecting other keyword nodes[10].

4.2. Keyword Cluster Map Analysis

In order to further analyze whether the research hotspots in the field of educational artificial intelligence are common, the keyword clustering knowledge map was drawn for visual analysis, as shown in Figure 6.

This paper uses Citespace to use the keyword to use "LLR" algorithm for cluster analysis, you can get 10 cluster categories, which are # 0 artificial intelligence, # 1 intelligent education, # 2 machine learning, # 3 technology, # 4 learning space, # 5 education application, # 6 big data, # 7 intelligent technology, # 8 information literacy, # 9 influencing factors. The cluster module value Q is 0.5913, and the average profile value S is 0.9155. According to the general judgment criterion, the Q value is greater than 0.3, indicating that the module structure is reasonable; the S value is greater than 0.7, indicating that the cluster is convincing.

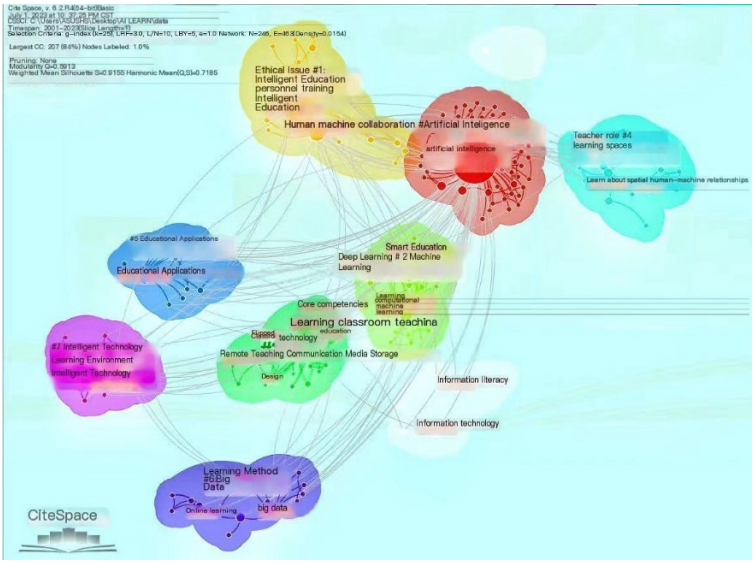

Figure 6: Keyword cluster map

On this basis, run the Summarization of Clusters function in CitaSpace software to get the network clustering table of artificial intelligence technology and learning. The author makes statistics on each cluster and obtains the data in the table and the identification words under each cluster (select the top 5), as shown in Table 4.

ISSN 2616-7433 Vol. 6, Issue 7: 126-135, DOI: 10.25236/FSST.2024.060718

Table 4: Keyword clustering table

Cluster number	Clustering words	Cluster size	Characteristic words (LLR algorithm)
0	artificial intelligence	57	Artificial intelligence; machine learning; intelligent education; learning; technology
1	Intelligent education	31	Intelligent education; human-machine collaboration, talent training; hybrid enhanced intelligence; ethical risk
2	machine learning	27	Machine learning; intelligent education; deep learning; educational innovation; learning analysis
3	technology	20	Technology; learning; thinking skills; artificial intelligence; education
4	room for learning	16	Learning space; intelligent agent; intelligent technology empowerment; dwelling place; role construction
5	Education application	15	Educational application; 4d printing; text statistics; research review; value criticism

The research keyword clustering of "artificial intelligence technology and education learning" can be divided into three groups. The first group of clusters is: artificial intelligence technology, mainly for technology research, and a case study on the use of artificial intelligence technology. The second group of clusters is: educational application, mainly including the field of information technology application and education and the purpose to be achieved. The third group of clusters is: influencing factors, mainly the safety, ethics, risk and other studies generated by technology application.

4.3. Keyword Timeline Analysis

The timeline visualization view can clearly present the change of a research topic, the relevance of the research, and the evolution trajectory of the research focus within a period of time [11]. In this study, the Timeline View function of CiteSpace 6.2.R4 software was used to map the keyword clustering time zone, as shown in Figure 7:

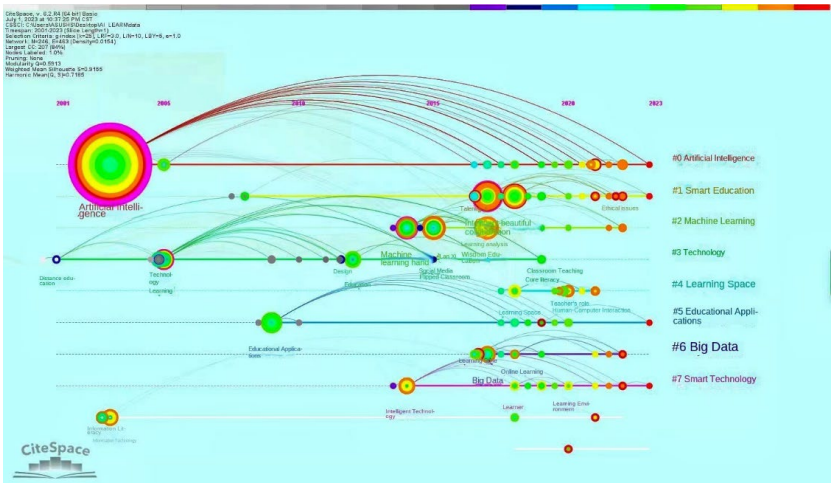

Figure 7: Timeline map of the keywords

According to the figure, researchers' research on artificial intelligence technology and educational learning has continued from 2001 to today, and the popularity has not been reduced. Cluster # 0 AI has been a research focus since 2003. Cluster # 1 Intelligent education, which began in 2017, has since become the core of research in the field of education."Human-machine collaboration" and "hybrid enhanced intelligence" under the research theme are hot topics in the application of artificial intelligence technology in the field of education in recent years, and intelligent education will be the trend of future research. Cluster # 2 machine learning, which began in 2014, will continue in 2023. In addition, the research topic includes "deep learning" and "learning analysis", the research topics in the field of education, which will be the focus of research in the next few years. Cluster # 3 technology, which appeared first, began in 2001 and has been an important research issue until 2019. Cluster # 4 learning space, which received more attention between 2018 and 2021. Cluster # 5 education application, started

ISSN 2616-7433 Vol. 6, Issue 7: 126-135, DOI: 10.25236/FSST.2024.060718

in 2009, the heat continues to this day. Cluster # 6 big data, which started in 2017. Big data in education has been a major research hotspot in recent years and has attracted the attention of many researchers. Cluster # 7 intelligent technology, similar to machine learning, is mainly for the research of intelligent technology. Cluster # 8 information literacy was mentioned in 2003, and its research is still concerned by researchers, and it is also a key research issue in the field of information technology education. With the continuous development and application of artificial intelligence technology, technology ethics and influence have been the main focus and research issues in the past two years.

5. The Application and Influence of Artificial Intelligence Technology on Learning

AI technology has had a profound impact on the field of learning. It has been applied in multiple learning environments, such as computer-aided teaching, personalized learning, intelligent evaluation and feedback. These applications bring many benefits to learners.

First, AI technology improves the personalization and customization of learning. Optimize the learning environment and recommend appropriate learning paths and content for students, aiming to provide students with personalized learning experience[12]. Through the analysis of learners' data and models, AI systems can provide customized learning resources and learning paths according to the needs and characteristics of learners, so as to improve the learning effect and meet individual differences. Second, AI technology provides more learning support and feedback. Intelligent education tools can help learners find and correct errors and strengthen the understanding and application of knowledge through automated evaluation and immediate feedback. This form of personalized feedback is very important for learner learning motivation and autonomy. In addition, AI technology has changed teaching methods and the role of teachers. Traditional teaching methods emphasize knowledge transmission, but with the development of artificial intelligence technology, the role of teachers is changing into the guide and guide of learning. AI technology gives teachers more time and resources to pay attention to learners' personalized needs and ability cultivation.

Future directions include further improvement of teacher-student interaction, the introduction of virtual teachers and learning partners, and promoting the development of integrated learning and interdisciplinary teaching. At the same time, the education community also needs to pay attention to the challenges and ethical issues posed by AI technologies in learning, such as personal privacy and data security, and the fairness and transparency of algorithms that need to be emphasized to ensure that these technologies are used in a reasonable and responsible way. In addition, the research needs to further explore how to make full use of artificial intelligence technology and integrate it into effective educational theories and practices, so as to truly improve the learning effect of learners and cultivate well-rounded individuals.

In conclusion, the impact of AI technology on learning has shown broad potential, and it is changing the way of learning and the practice of education. However, the challenges and future development opportunities also need further research and attention. Through continuous exploration and innovation, AI technology will bring greater benefits to learners, teachers and education.

6. Conclusions

Through bibliometric research methods, research samples were selected from CNKI database, and 309 Chinese academic papers in the field of "Artificial Intelligence Technology and Education learning" from 2001 to 2023 were selected. CiteSpace 6.2.R4 software was used to analyze knowledge graph, and Excel software was also used to make statistics and visualize the number of literature source journals and annual publications. The results of this paper can provide research directions and ideas for researchers in the field of "artificial intelligence technology and educational learning". The following research conclusions are mainly drawn:

(1) According to the journal statistics of research literature sources, the top 10 journals in the number of articles published on this topic are all the core journals in the field of educational technology, and the quality of the journals is above average. In addition, the journals of artificial intelligence technology and educational learning and research can be roughly divided into three categories, namely, comprehensive education journals, educational technology journals and higher education journals.

(2) According to the statistics of the number of publications, from 2001 to 2016, there were few studies on "artificial intelligence technology and education learning" in China, and the research was

ISSN 2616-7433 Vol. 6, Issue 7: 126-135, DOI: 10.25236/FSST.2024.060718

relatively stable, and the number of publications was small. Since 2017, the number of studies published on "artificial intelligence technology and Education learning" in China has increased significantly, with more than 20 articles every year.2022 is the highest number of publications.

(3) From the perspective of the distribution network of research authors, there are relatively few cooperative groups of researchers, and the multi-person researcher cooperative network with close research mainly includes five groups, most of which are three research groups. The cooperation density between the authors' nodes is low, the researchers are relatively scattered, and no real cooperative relationship has been formed. From the perspective of the number of authors per capita, there are few productive authors in domestic journals, and the research depth in this field is relatively lacking.

(4) From the perspective of the distribution network of research institutions, research institutions are relatively scattered, the cooperation is not close enough, there are more independent research within institutions, and no stable cooperation group of high-yielding institutions,

(5) From the analysis of research hotspots, the most frequent words are: artificial intelligence, intelligence education, human-machine collaboration, learning, and intelligence education, which shows that the research of these subjects is relatively active, and it plays an important role in connecting other keyword nodes.

(6) From the perspective of research clustering and research time trend, a total of 10 cluster categories were obtained. The structure of the cluster module is relatively reasonable and the clustering is convincing. The research in the field of "artificial intelligence technology and education learning" has been attracting attention since 2001, and has not been popular yet. Moreover, intelligent education, educational application, intelligent technology and influencing factors are the future research trend.

Future directions involve further improving the application of AI technologies in the learning field and addressing related challenges. Such as personal privacy and data security issues. With the development of artificial intelligence technology, the technology is constantly mature and optimized, and can not stay in the field of knowledge and skills, nor can they ignore the emotional field, because learners are complex and full of emotion, how technology has a positive impact on learning is worth discussing. In addition, teachers and teaching and research staff at all levels should constantly carry out teaching reform, reconstruct the teaching mode, update and integrate artificial intelligence subject knowledge, promote the deep integration of education and artificial intelligence, and make artificial intelligence products not only "intelligent", but also pay more attention to "emotional" [13].

Acknowledgements

Fund Project: 2024 Graduate Scientific Research Innovation Fund of Yunnan Normal University:" Research on Integrated Design of Educational Games and Science Knowledge —— Design of Physics and Electrical Knowledge as an Example" (Project No.: YJSJJ23-B120).

References

[1] F.Li, J.Sheng, W.Huang: The breakthrough point of education digital transformation: the design and implementation of intelligent teaching materials[J]. Journal of East China Normal University (Education Science Edition),2023,41(03):101-109.
[2] M.H.Yu, X.Feng, Z.T.Zhu: Exploration of educational application and innovation of machine learning in the view of artificial intelligence[J]. Journal of Distance Education,2017,35(3):11-21.
[3] S.H.Lv, Y.W.Peng: A review of research on Chinese primary and secondary mathematics textbooks in the last two decades - based on CiteSpace knowledge mapping analysis[J]. Journal of Mathematics Education,2019,28(4):48-54.
[4] R.Li: Adaptive learning: a revolution in education in the age of artificial intelligence [M]. Beijing:Tsinghua University Press,2019.
[5] M.Y.He, R.Li: International Research Hotspots and Trends of Adaptive Learning Platforms from 2010 to 2021-Based on CiteSpace Visualisation [J]. Journal of Yunnan Normal University: Natural Science Edition,2022,42(3):67-74.
[6] Z.J.Mou, X.Yu: Academic community and hotspot tracking of learning analytics from the perspective of knowledge graph analysis - A meta-analysis of the International Conference on Learning Analytics and Knowledge[J]. Journal of Distance Education,2016,35(02):54-63.
[7] Y.M.Sheng, Q.Liu: Analysis of international artificial intelligence research hotspots and trends based

ISSN 2616-7433 Vol. 6, Issue 7: 126-135, DOI: 10.25236/FSST.2024.060718

on CiteSpace [J]. Software Engineering, 2022, 25(11):35-3834.
[8] Q.C.Guo, X.Y.Du, Y.Yzhang, Y.Zhou: Three-dimensional path planning for UAVs based on improved whale algorithm[J]. Computer Science,2021,48(12):304-311.
[9] S.H.Lv, Y.W.Peng: A review of research on Chinese primary and secondary mathematics textbooks in the last two decades - based on CiteSpace knowledge mapping analysis[J]. Journal of Mathematics Education,2019,28(4):48-54.
[10] Huei-Tse Hou and Kuo-En Chang and Yao-Ting Sung. An Analysis of Peer Assessment Online Discussions within a Course that uses Project-based Learning[J]. Interactive Learning Environments, 2007, 15(3) : 237-251.
[11] Y.Chen, C.M.Chen, Z.G.Hu, et al. Principles and applications of cite space analysis: A practical guide to Cite Space[M]. Beijing: Science Press,2014.
[12] Z.M.Yan, X.X.Tang, X.Qin, et al. Connotation, key technologies and application trends of educational artificial intelligence (EAI) - Analysis of the reports "Preparing for the Future of Artificial Intelligence" and "National Artificial Intelligence R&D Strategic Planning" in the United States [J]. Journal of Distance Education, 2017(1):26-35.
[13] Y.Y.Guo, Yingying, D.Liu: A review of domestic educational artificial intelligence research in the last decade - based on CiteSpace knowledge mapping analysis[J]. Software Guide, 2022, 21(1):69-74.