The Impact of the Application of AI Technology in the Field of Education on Educational Fairness and Countermeasures

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Abstract. In the field of education, artificial intelligence (AI) technology continues to develop and is widely used, such as intelligent teaching systems, educational resource recommendations, intelligent evaluation and feedback. At the same time, as an important issue in the field of education, the connotation of educational fairness includes starting point fairness, process fairness and result fairness, but at present, the phenomenon of educational unfairness is still prominent, and there are significant gaps in educational resources between urban and rural areas, regions and schools. In this context, this paper aims to discuss the impact of artificial intelligence technology on educational fairness. AI has shown great potential in optimizing the allocation of educational resources, realizing personalized learning and improving the quality of education, providing a new way and method for promoting educational equity. But at the same time, it also brings challenges such as technology application gap, algorithm bias and over-dependence. Strategies such as policy support, teacher training and data management can effectively address these challenges and give full play to the positive role of AI technology in promoting education fairness. This study deeply analyzes the application status of artificial intelligence technology in the field of education, comprehensively discusses its multidimensional impact on educational fairness, and proposes countermeasures with strong pertinence and practical guiding significance.

Keywords: Artificial Intelligence, educational fairness, personalized learning, educational resource allocation, algorithmic bias

1 Introduction

In today's digital era, artificial intelligence technology is penetrating the field of education at an unprecedented speed, and its influence is increasingly far-reaching, which has become a key factor in the pattern of education equity. Educational equity, as one of the most important cornerstones of social equity, is deeply related to everyone's development opportunities, and is the core driving force for sustainable social progress. As Wang Junfeng pointed out in his in-depth analysis of the vision of distance and open education to promote education equity in rural China, in the article Urbanization,

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distance education plays an indispensable role in promoting education equity in urban and rural areas [1]. With the rapid development of science and technology, the deep integration of artificial intelligence and distance education has undoubtedly opened up a broader development space for the realization of educational equity. This integration trend not only breaks the time and space restrictions of traditional education, but also enables high-quality education resources to cross geographical boundaries and cover all regions more evenly, especially in rural and remote areas where education resources are relatively scarce. This paper deeply analyzes the relationship between artificial intelligence technology and educational fairness, helps to fully understand the advantages and disadvantages of technology application in the field of education, provides a decision-making basis for education policymakers, and promotes the rational allocation of educational resources. To provide practical guidance for educators to help them make better use of artificial intelligence technology to achieve personalized teaching, improve the quality of education, and promote the realization of educational equity. Arouse the attention and thinking of society on the issue of educational equity in the era of artificial intelligence, promote multi-party cooperation, and jointly explore new models and new methods of educational equity, aiming at promoting the deep integration of artificial intelligence and education, helping the realization and improvement of educational equity, and providing useful references for the development of education.

2 The Application Status of Artificial Intelligence Technology in the Field of Education

2.1 Intelligent Teaching System

Highly personalized adaptive learning platforms are emerging. Through accurate knowledge atlas construction and complex algorithms, real-time tracking of students' learning trajectories can not only dynamically adjust teaching content and difficulty according to students' answers and learning speed, but also predict students' learning bottlenecks and intervene in advance. These systems use natural language processing technology to interact with students, simulate real teaching scenes, and provide 24-hour uninterrupted learning support, which has greatly changed the fixed mode of traditional teaching.

2.2 Recommendation of Educational Resources

With the help of big data analysis and machine learning algorithms, platforms such as NetEase Cloud Class can integrate massive educational resources and select high-quality courses and learning materials from the whole world that meet students' interests, abilities and learning goals. At the same time, through the continuous monitoring and analysis of students' learning behaviors, such as learning time, course completion rate, knowledge point mastery, etc., the recommendation results are constantly optimized to achieve the accurate push of educational resources, so that students can quickly find the most suitable learning resources and avoid being lost in the flood of information.

2.3 Intelligent Evaluation and Feedback

Advanced intelligent evaluation systems have been widely used, for example, in the English writing correction network, not only can quickly identify basic errors such as grammar, vocabulary and spelling, but also can use deep learning algorithms to comprehensively evaluate the logical structure, content richness and language expression fluency of the article, and give detailed correction suggestions and scores. Some systems can also compare and analyze students' work with students in the same grade, the same region or even the whole country, providing teachers and students with a more comprehensive and objective evaluation of learning, and helping students to clarify their position and promotion direction in the group.

3 The Connotation and Current Situation Analysis of Educational Fairness

3.1 The Connotation of Educational Fairness

Educational equity includes three levels: starting point equity, process equity and result equity. Starting point equity emphasizes that every student should enjoy equal opportunities to receive education, regardless of family background, region, race and other factors. Process equity focuses on the rationality of the distribution of educational resources, the fairness of the teaching process and the attitude and way of teachers to students. Outcome equity expects that after receiving education, different students can fully develop knowledge, skills and moral character according to their own efforts and talents, obtain educational results that match their efforts, realize the enhancement of personal and social value, and lay a solid foundation for future career development and social life.

3.2 The Current Situation of Educational Fairness

Now, the phenomenon of educational inequity is still prominent. There is a significant gap in educational resources between urban and rural areas. Urban schools are equipped with modern laboratories, multimedia classrooms, intelligent teaching equipment and other hardware facilities, while rural schools may only have basic teaching tools, unstable network coverage, insufficient number of computers and backward configuration. The development of education is unbalanced among regions, and the developed eastern regions far surpass the central and western regions in education informatization construction, quality of teachers, and investment in education funds. Among schools, due to the popularity of schools, educational resources and other factors, resulting in excessive concentration of high-quality students and teachers, weak schools are faced with survival difficulties, and difficulty to provide high-quality educational services, seriously affecting students' right to receive fair education.

4 The Positive Impact of Artificial Intelligence Technology on Educational fairness

4.1 Improving the Distribution of Education Resources

From Basic Equity to Differential Equity: It is pointed out in the research perspective of informatization to promote basic education equity that informatization means can break the barriers of uneven distribution of basic education resources, and artificial intelligence technology, as an important driving force of informatization, plays a key role in promoting the flow and sharing of high-quality educational resources, providing a new opportunity for the realization of basic education equity [2]. Through the Internet and cloud computing technology, massive open online courses (MOOC) platforms, such as the MOOC of Chinese universities, make high-quality courses of top universities free to the whole society, so that students in remote areas and poor families can across geographical restrictions and simultaneously learn courses from famous teachers. In Research on the Application of AI Education in Rural Basic Education Equity, Zhao Yangjing, Mo Meixian and other scholars used CiteSpace software to visually analyze relevant literature and found that the application of AI education in rural basic education can effectively improve the current situation of lack of educational resources, improve the quality of rural education, and promote the equitable development of urban and rural education [3]. Some regions use artificial intelligence technology to build an education resource-sharing platform, integrate high-quality education resources within the region, and realize the communication of resources between urban and rural schools and strong and weak schools. For example, the remote synchronous classroom allows rural students to participate in the classroom teaching of high-quality urban schools in real time and share high-quality teachers, effectively bridging the regional gap in education resources. It provides strong support for realizing equality of the starting point of education.

4.2 Realizing Personalized Learning

In the Exploration of Artificial Intelligence to Promote Regional Educational Equity, Wu Zhaolong proposed that paying attention to the systematic application of artificial intelligence and the construction and transfer of knowledge, paying attention to the individual differences of students, and providing personalized learning support for students by using artificial intelligence technology will help realize regional educational fairness [4]. The AI-driven learning analysis system can dig deeply into students' learning data and build a detailed portrait of students' learning, including multi-dimensional information such as learning style, interests, knowledge mastery, and learning ability. Based on these portraits, educational software such as master one to one can tailor an exclusive learning plan and path for each student, providing targeted learning content and practice topics, meeting the diverse learning needs of different students, ensuring that each student can be fully developed in their own areas of excellence, maximize the potential of students, and make the education process fairer and more efficient.

4.3 Improving the Quality of Education

In *Application of Artificial Intelligence in Higher Education from the Perspective of Learning Effect and Education Equity: A Review of English peer-reviewed journal literature based on multiple databases*, Hao Dan and Xiao Junhong pointed out that the application of artificial intelligence in higher education helps to improve students' learning effect and education quality and thus has a positive impact on education equity [5]. Intelligent tutoring systems, such as iFlytek's Intelligent learning network, can provide teachers with comprehensive analysis of teaching data, including students' mastery of knowledge points, error-prone questions, learning progress, etc., to help teachers accurately locate teaching priorities and difficulties, timely adjust teaching strategies, and achieve individualized teaching. At the same time, the application of artificial intelligence technology in teaching evaluation makes the evaluation more objective, comprehensive and accurate, and can timely feedback students' learning results and progress, encouraging students to actively learn, promoting teachers to continuously improve teaching methods, so as to improve the overall quality of education, narrow the gap in education quality caused by differences in teachers and teaching methods, and promote the realization of equitable education results.

5 The Possible Negative Impact of Artificial Intelligence Technology on Educational Fairness

5.1 New Gaps Brought About by Technology

Dai Zhishan mentioned in *The Definition of the Concept of Artificial Intelligence in the Field of Education in China and the Exploration of Educational Equity* that there are regional differences and digital divides in the application of artificial intelligence in education in China, and some regions and groups cannot access and apply technology, which affects the realization of educational equity [6]. Due to the lack of necessary technical equipment, some poor areas and vulnerable groups cannot access online education platforms and miss out on high-quality education resources. At the same time, due to the lack of digital literacy, some students and teachers are not familiar with the operation and application of artificial intelligence education tools, resulting in the process of education informatization gradually lagging behind, forming a new educational inequity. Moreover, the rapid upgrading of technology and the different investment capacities of different regions and schools in technology upgrading further aggravate this gap, putting some students at a disadvantage in obtaining educational resources and using technology to improve learning results.

5.2 Algorithm Bias Problem

Mutlu Cukurova in The Interplay of Learning, Analytics and Artificial Intelligence in Education: A Vision for Hybrid Intelligence explores data analysis and algorithmic issues in the application of artificial intelligence in education, highlighting the negative impact that algorithmic bias can have on educational equity [7]. The operation of

artificial intelligence algorithms depends on a large amount of data, and if the data is biased or incomplete, it may produce unfair results. For example, in some intelligent admissions systems, if the algorithm relies excessively on historical admissions data, and there is a bias toward admission for a particular region or group, it may continue to favor these groups, while causing unfair screening for other students with potential but different backgrounds, limiting their educational opportunities, and undermining the principle of educational equity.

5.3 Over-reliance on Technology

In her book *Educational Equity in the Age of Artificial Intelligence: From the Postmodern Philosophical Turn of Lyotard's View of Justice*, Zhao Juan reflected on the problem of over-reliance on technology in education in the age of artificial intelligence from a philosophical perspective, and pointed out that we should pay attention to the relationship between technology and people to avoid the alienation of technology to the connotation of educational equity [8]. Over-reliance on artificial intelligence technology for teaching may lead to deficiencies in the cultivation of students' non-cognitive abilities such as interpersonal communication, emotional communication, and teamwork. Students interact with smart devices for a long time, reducing the opportunity to communicate face-to-face with teachers and classmates, which may affect the development of their language skills, empathy, social adaptability, etc. In addition, if teachers over-rely on intelligent teaching tools, they may gradually lose their initiative and creativity in teaching, and unable to adjust the teaching method flexibly according to the actual teaching situation, the teaching process becomes rigid, difficult to truly meet the individual needs of students, and ultimately affect the realization of education quality and education equity.

6 The Strategies of Artificial Intelligence Technology to Promote Education Fairness

6.1 Policy Support and Resource Input

Zheng Yanlin and Jia Baolong introduced the policy support and resource investment strategies of the British government in the field of AI education in the Path and Measures for Promoting Balanced Education Development in the Era of AI, which provided useful international experience for China and helped improve the policy system and resource allocation mechanism of promoting educational equity in China [9]. The government should play a leading role, formulate sound education informatization development policies, clarify the development direction and key tasks of artificial intelligence in the field of education, set up special funds, increase capital investment in poor areas and weak schools, improve network infrastructure construction, and ensure that every student has equal access to artificial intelligence education resources. At the same time, enterprises and social institutions are encouraged to participate in educational public welfare projects, and contribute to the cause of educational equity through

donations and technical support, so as to form a resource investment mechanism for the coordination of the government, enterprises and society, and jointly promote the balanced development of education informatization.

6.2 Teacher Training and Capacity Improvement

Schools should construct a systematic artificial intelligence training system for teachers, and design hierarchical and classified training courses for teachers of different teaching ages, disciplines and technical levels. The training content should not only cover the basic knowledge of artificial intelligence and the operation skills of common educational software and tools, but also cover the methods and strategies of how to effectively integrate artificial intelligence technology into teaching practice, such as the use of intelligent teaching system to carry out personalized teaching, and the use of learning analysis data to optimize the teaching process. At the same time, schools are expected to establish a certification mechanism for teachers' artificial intelligence application ability, encourage teachers to continue learning and improve their technology application ability, and provide teacher protection for education equity.

6.3 Data Management and Ethical Protection

Liliyan Breanne Krystine Litts and others in Youth's Relationship with Culture: Tracing Sixth Graders' Learning Through Designing Culturally Centred Multimedia Projects pointed out that while using artificial intelligence technology to create a diverse learning environment for students, the teachers should pay attention to the rational use and ethical issues of data, and ensure that the application of technology is in line with the principles of educational equity and student development [10]. Educational institutions should establish a strict data management system to standardize the process of collection, storage, transmission, use and sharing of educational data. They should strengthen data security, adopt encryption technology, access control and other means to prevent data leakage and abuse, and protect the private information of students and teachers. When designing and applying algorithms, relevant departments need to introduce an ethical review mechanism to ensure the fairness, transparency and interpretability of the algorithm. They should establish diverse and representative education data sets to avoid algorithmic bias caused by data bias. Authorities should regularly evaluate and audit AI education systems to monitor their impact on educational equity and to identify and correct potential inequities in a timely manner. At the same time, schools and educational departments should strengthen education data ethics education for teachers, students and parents, improve their awareness of data protection and ethics, and create a healthy, fair and orderly environment for the application of artificial intelligence education.

7 Conclusion

7.1 The Conclusion of the Study

This study deeply discusses the application status of artificial intelligence technology in the field of education and its complex impact on educational equity, and puts forward corresponding solutions. Artificial intelligence technology has shown great potential in optimizing the allocation of educational resources, realizing personalized learning and improving the quality of education, providing a new way and method for promoting educational equity. However, it also brings new challenges in terms of technology application gap, algorithm bias and over-dependence, which cannot be ignored. Strategies such as policy support, teacher training and data management can effectively address these challenges and give full play to the positive role of AI technology in promoting educational equity.

7.2 Future Outlook

With the continuous development and innovation of artificial intelligence technology, the deep integration of emerging technologies such as 5G, blockchain, virtual reality and artificial intelligence will bring more opportunities for educational fairness. In the future, intelligent education environment will be more popular and perfect, education resources will be more balanced distribution, personalized learning will become the new normal of education, every student can enjoy the most suitable for their own quality education services. However, people should also be clearly aware that the development of technology is a process of continuous evolution, in the pursuit of educational fairness on the road, the government need to continue to pay attention to the integration of technology and education, continue to optimize strategies and measures, strengthen international cooperation and exchanges, and jointly explore new models and new methods of educational fairness in the era of artificial intelligence.

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