Can Artificial Intelligence-Generated Content (AIGC) Bridge the Gap? A Review of Technology's Role in Educational Equity

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Abstract: Educational fairness is the common pursuit of human society. It is an important foundation of social fairness. There is an inherent and inevitable connection between education and technology. Currently, the situation of global educational inequality is severe, while technology-driven educational innovation has great potential. The emergence of Artificial Intelligence-Generated Content (AIGC) technology is influencing and will continue to influence the field of education. This influence will promote the development of educational fairness in many ways, such as shaping a fair environment inside and outside education, spreading the concept of fairness and justice, replicating high-quality classroom resources, making up for the shortage of excellent teacher resources, and meeting students' personalized learning needs. However, the role of AIGC technology also has limitations in promoting educational fairness. This study explores the relationship between educational fairness and AIGC from the perspective of educational fairness, aiming to provide guidance for its subsequent application and help achieve the goal of educational fairness.

Introduction

Ensuring high-quality and fair education is also an important part of the United Nations Sustainable Development Goals (Haleem et al., 2022). Digital technology is an important tool for achieving educational fairness. The COVID-19 pandemic has further institutionalized the application of digital technology in education. The application of technology in the field of education is becoming more and more widespread. Technology-enhanced learning (TEL) has become a widely accepted term. It is usually used to describe the interface between digital technology and teaching (Cushion & Townsend, 2019). Technology is not only a provider of knowledge but also a co-creator of information. Science announced the top ten scientific and technological breakthroughs in 2022, and AIGC was on the list. Garten even listed AIGC as one of the top strategic technologies in 2022. The MIT Technology Review also classified AIGC as a breakthrough new technology in 2022 (Zhang et al., 2023). The concept of generative learning has a long history. The evolution of applications and paradigms brought about by technological iterations is a major opportunity for the self-reform of education (Pedro et al., 2019).

Fairness and efficiency have always been core issues that cannot be avoided and are of crucial importance in the process of educational development. In the present era, the emergence of AIGC has opened a brand-new path for promoting educational fairness. AIGC has powerful voice and text communication functions. This characteristic has brought unprecedented convenient learning experiences to learner groups in economically backward areas and brought convenient and high- quality learning opportunities to special learners. Moreover, AIGC can also provide equal learning tutoring services for many learners. Whether it is answering various knowledge questions or giving highly targeted learning suggestions, it can handle them with ease, thus effectively alleviating the educational dilemma caused by a shortage of teachers. In areas with weak educational resources, learners no longer need to worry about the lack of teacher tutoring (Li and Xue, 2024). And learners at different cognitive levels and abilities also could obtain more personalized and precise help and guidance that suits their own needs. This enables educational fairness to be better demonstrated and implemented with the help of technology and injects a strong impetus into promoting the balanced and efficient development of the overall education cause. The application of AIGC in education has created new opportunities for achieving educational fairness and high-quality education goals. However, there are still many challenges in implementing relevant activities (Kay, 2012).

In the following chapters, we will mainly study the demand for education for AIGC technology. Briefly introduce the importance of Artificial Intelligence Generated Content (AIGC) technology in education, determine the role of AIGC technology in achieving educational fairness, analyze the challenges of AIGC technology in achieving educational fairness, and provide guidance for the future application of AIGC technology.

Educational Equity

Educational fairness means configuring educational resources according to reasonable norms and principles. In 2014, UNESCO discussed the importance of educational inclusiveness and benefiting all children (Opertti et al., 2014). It ensures that every learner has the right to get the same educational opportunities. In 2015, UNESCO released the "Education 2030 Framework for Action" (Mundial & Unicef, 2016). This framework emphasizes that inclusiveness and fairness are the foundation of high-quality education. All forms of exclusion and marginalization, as well as differences and inequalities in access, participation, learning processes, and results, must be addressed. From this, we can see that the international agenda for education for all must truly involve everyone. Besides, educational fairness can be divided into fairness at the starting point, in the process, and in the results (Ainscow, 2020). Fairness at the starting point means that everyone, regardless of gender, origin, race, and economic status, could start their learning career. Process fairness refers to treating everyone equally. Result fairness means the equality of educational quality.

In all aspects of education, whether it is when obtaining educational resources, participating in learning activities, during the learning process, or in terms of the results, all forms of exclusion, marginalization, as well as existing differences and inequalities must be properly resolved. This clearly shows that the core of the international education must truly cover everyone, and no one who is eager to learn should be left out. In terms of the development and realization of educational fairness, education is the ideal and pursuit goal of human society. However, its realization can't be achieved

overnight. Instead, it needs to go through a long historical process. And it can't do without the support of economic conditions, the guarantee of the political environment, and the help of scientific and technological strength. People can only achieve the limited goals of educational fairness step by step according to the conditions gradually provided by the social and historical development process and create a fairer educational environment for more people at different stages.

Educational technology
The development of educational technology is an important condition for achieving educational fairness. The COVID-19 pandemic has made various institutions attach more importance to the role of technology in the field of education. Developed countries are already ready to deal with this crisis. However, developing countries are still working hard to meet this requirement (Haleem et al., 2022). Technology has broken the traditional teaching mode and diversified teaching forms. Technical forms such as audio, video, and animation have been widely used in teaching. Educational technology has been identified as a core element of all teacher education (Roblyer & Doering, 2014). Meanwhile, technology can improve learners' autonomous learning ability (Pan, 2020). It enables learners to explore learning methods according to their own preferences. In the educational environment, technology may increase educational opportunities and improve educational quality and relevance. Technology has four roles in the field of education. It can be used as an educational system, an auxiliary teaching tool, a part of the curriculum, and also a tool to enhance the learning process.

Then, does information technology promote educational fairness or exacerbate educational unfairness? To answer this question, we can explore it according to the following three basic logic. Firstly, clarify the connotation of educational fairness in terms of value propositions in the context of time and space. Based on this connotation, identify the prominent restrictive factors involved. Secondly, examine the role that technology plays in eliminating the above prominent restrictive factors and to what extent it can eliminate these factors. Thirdly, pay attention to whether new problems will emerge during the process of technology eliminating the established prominent restrictive factors. And whether these new problems will hinder the progress of educational fairness.

The relationship between educational equity and educational technology
From the perspective of academic research, the study on the interactive relationship between information technology and educational fairness is an important research topic in the field of education. Because the application of information technology in the field of education is complex and multifaceted, its impact on educational fairness involves many factors (Wang et al., 2024). Therefore, the academic community has not reached an agreement on whether information technology can really promote educational fairness. At present, three basic viewpoints have mainly been formed, namely "the theory of technology promotion", "the theory of technology limitation" and "the technology gap"(Zheng et al., 2023). The theory of technology promotion believes that compared with human teachers, artificial intelligence can be fairer and more just. In future education, through the flexible transformation between physical resources and digital resources, the personalized teaching needs of teachers and students can be better met (Ding, 2024). The optimization of educational resource allocation is the

key to solving the problem of fairness at the starting point and the entry point for information technology to solve the problem of educational fairness.

When examining the relationship between technology and educational opportunities and the process of eliminating existing unfairness, fairness in educational opportunities, fairness in the educational process, and fairness in educational results should all be included in the scope of the examination. Fairness in educational opportunities is the primary value proposition of educational fairness and it is a prerequisite for realizing other fairness propositions (Husen, 2014). Educational process fairness plays a very crucial role in the whole education system because it has a profound impact on learners' learning experiences. Education is not just the isolated transmission of knowledge. Its process is completed gradually through diverse interactions among people. The key for information technology to promote educational process fairness lies in eliminating the effects of unfair mechanisms caused by traditional human factors. Students from different regions can obtain similar high-quality course resources and could have remote interactive exchanges with excellent teachers. This has greatly broadened the boundaries of learning and enables every student to grow up in a relatively equal educational process. Educational result fairness is the phased presentation of the results of educational activities at various stages. It reflects the comprehensive achievements of students in aspects such as knowledge acquisition and ability improvement. Although educational technology has both possibilities and limitations in promoting educational result fairness and cannot eliminate all influencing factors, it has also changed the way of generating traditional educational result unfairness.

AIGC technology in education
Artificial Intelligence Generated Content (AIGC) technology is a branch of computer science. Its purpose is to generate new data samples that mimic existing data sets. The Variational Autoencoder (VAE) is the basis of AIGC technology. It can learn to encode and decode data in a way that keeps the basic features (Kingma, 2013). It combines computer science, physiology, and philosophy. AIGC, with large-scale as the core, gathers collective wisdom. It can deeply empower human knowledge and abilities and at the same time change the form of knowledge. It has covered the previous knowledge dissemination patterns. The globalization of education requires the application of technology. The unique intelligent model of AIGC can "understand" the meaning of the speaker and give effective feedback, reaching a level of "being almost indistinguishable from the real". It has changed from understanding the world in the past to generating the world now. The content and form of generation have also been strengthened unprecedentedly, leading artificial intelligence towards the future of "Model as a Service" (Vulkan et al., 2025). In the field of education, AIGC technology has been applied to creating course content, generating personalized learning materials, and enhancing interactive teaching. For example, AIGC technology can generate customized textbooks and exercises according to students' learning levels and preferences, to improve learning efficiency and participation (Zhang, 2024). Current literature mostly reports the uses, purposes, and challenges of educational technology in the field of higher education learning. There is a gap in the literature on researching technology in narrowing the educational gap. Therefore, attention needs to be paid when promoting and applying it.

Methodology
This research is descriptive. It focuses on the exploration of AIGC technology in the field of educational fairness and generally shows descriptive characteristics. Its core purpose is to deeply understand the important of AIGC technology in vigorously promoting the process of educational fairness and accurately explore practical realization approaches. It also determines the problems related to narrowing the educational gap and possible solutions according to AIGC technology. In terms of research methods, this research adopts the qualitative research paradigm. A detailed and systematic evaluation is carried out on the collected literature. The main sources of data used are journals, search engines, and academic articles. Keywords such as "educational fairness", "AIGC", "educational technology" and "technology-enhanced learning" are used to search for relevant papers. Among the numerous papers searched, careful screening was carried out according to the quality level of the papers themselves and the close relevance to the research question, ensuring that each paper included in the research scope has a high reference value. During the literature evaluation process, the literature is classified and sorted. It is classified according to dimensions such as theme, viewpoint, and research method, to clearly sort out the application performance of AIGC technology in various aspects of educational fairness. Then it is classified according to different viewpoints, to comprehensively present the diverse cognitive perspectives of the academic community on the relationship between AIGC technology and educational fairness. It is also sorted according to the differences in research methods, providing multi-dimensional research thinking references for subsequent analysis. The research content, conclusions, and limitations of each paper are deeply analyzed. Key information about the role, problems faced, and coping strategies of AIGC technology in educational fairness is extracted. Through comprehensive in-depth analysis and comprehensive inductive summary of these massive secondary data, a comprehensive, three-dimensional, and in-depth cognitive system about the relationship between AIGC technology and educational fairness is gradually constructed. It provides a solid theoretical foundation and practical reference basis for further research, educational practice, and policy formulation.

Results and Discussion
The Proposition and Constraining Factors of Educational Fairness
When exploring whether technology can promote educational fairness, we need to clarify the value proposition of educational fairness. Looking for the possibility of technology in realizing the fair value among specific value propositions is the prerequisite for exploring this issue. The reason why clarifying the value proposition of educational fairness is taken as a prerequisite is that educational fairness reflects relativity rather than absoluteness or certainty (Stufflebeam & Coryn, 2014). The value proposition of educational fairness is not a definite concept with a standard answer. Instead, it is a dynamically changing concept with the characteristics of time and space. The value proposition of this concept is deeply influenced by the economic, social, education development level and demographic. Based on the characteristics such as the stage and relativity of the value proposition of educational fairness, the value proposition of educational fairness in today's era should pursue a higher level, moving from the fairness of having the opportunity to receive education in the past to the higher-need and higher-quality educational fairness.

Condition fairness is an extension of opportunity fairness. It is the specific requirement of high-quality education in terms of material elements and external support with quality as the inspection index. It mainly involves the fairness of school-running resource allocation and enjoyment, as well as the fairness of different groups obtaining external support from the government, society, and families. It is to provide roughly the same education through standardized school construction and systematic condition support.

Educational process fairness emphasizes that during the development of educational teaching activities, every student can be treated equally and get appropriate development guidance. In classroom teaching, teachers should use diversified teaching methods according to the different characteristics and needs of students to stimulate students' learning interests and potentials, so that every student can feel respected and supported in the learning process without being affected by factors such as family background and talent differences. However, there are many restrictive factors in realizing educational process fairness. The unbalanced distribution of teaching staff seriously restricts educational process fairness. Excellent teachers are often concentrated in developed areas or key schools. They can provide students with high-quality teaching interactions by virtue of their rich teaching experience and professional qualities. However, in remote areas or weak schools, systemic challenges such as shortage of teachers and limited professional development persist. This creates a disparity between the ideal education, leaving a gap in student's access to high-quality teaching.

Educational result fairness means that after completing their studies, students from different backgrounds can reach a relatively balanced development level in terms of knowledge, skills, and qualities, and obtain similar educational achievements and social development opportunities. Its value connotation is reflected in that the education system can effectively eliminate the negative impacts of external factors such as the gap between the rich and the poor and regional differences on students' final development, so that every student can stand on his own feet in society and realize personal value by virtue of his own efforts. However, there are many obstacles to realizing educational result fairness. Developed areas have advanced teaching facilities, rich extracurricular practice opportunities, and extensive social resource networks. Students can obtain a more comprehensive educational experience in such an environment and lay a more solid foundation for future development (Cochran-Smith et al., 2016). However, students in poor areas are faced with the dilemma of a lack of educational resources, such as old experimental equipment, and a shortage of books and materials, which limits the expansion of their knowledge and skills and makes it difficult for them to compare students in developed areas in terms of educational results.

AIGC technology promotes educational fairness.
Artificial Intelligence Generated Content (AIGC) technology can be used to share resources and evaluate and manage daily educational activities (Chiu & Chai, 2020). AIGC can break the limitations of regions and resources and provide rich educational resources for learners in different areas. Students in remote areas can obtain high-quality courses and learning materials through the AIGC platform and get in touch with advanced knowledge and teaching concepts. It can narrow the gap in educational resources caused by regional differences, so that more people have the opportunity

to receive high-quality education, thus promoting fairness in educational opportunities. The unique intelligent model of AIGC can "understand" the meaning of the speaker's language and give effective feedback. AIGC is a general term for the production, manipulation, and modification of data or media (images, audio, video) through artificial intelligence algorithm models according to input instructions. AIGC is a technology that could generate and create information just like humans. It can independently generate new content through models such as training data and generation algorithms and has the ability to capture, analyze, and create information (Zifan & Haiyan, 2023). Educational technology needs to break through path dependence and innovate application scenarios. The breakthrough in educational technology needs to be achieved through the effective integration of humans and machines. AIGC's multi-modal scene interaction technology can create unlimited learning situations within a limited campus area. The optimization of the learning space is the foundation of the educational application scenario. AIGC can create a flexible and changeable learning environment for learners in terms of the presentation of teaching and learning content, the classroom environment, and teaching interaction. By providing accurate campus data support, it can create a smart education service space where everyone can learn at any time and in any place.

AIGC can generate personalized learning content and learning paths according to factors such as learners' learning habits, hobbies, and cognitive levels. During the teaching process, AIGC can offer personalized learning plans according to students' individual differences. The intelligent tutoring system can give precise tutoring for students' weak parts and provide customized learning paths for students with different learning progress. It makes sure that every student can get educational support suitable for their own development in the learning process. And it can avoid the unfairness in the process caused by different individual learning abilities and foundations. Studies show that learning is a social activity, and the core of learning is interaction and cooperation (Hurst et al., 2013). For learners with learning difficulties, AIGC can provide more basic learning materials and tutoring. AIGC can generate a variety of educational resources. For teachers, AIGC, as a tool, can help them complete teaching tasks (Ye et al., 2024).

AIGC can generate a lot of free or low-cost educational content, including textbooks, teaching plans exercise questions, etc., enabling more families to afford education expenses and reducing the educational gap caused by economic factors. Meanwhile, it can also provide teachers with training and learning resources to improve their teaching abilities and indirectly narrow the educational gap caused by differences in teachers' levels. Besides that, AIGC can enable learners in areas with scarce educational resources to access high-quality educational resources and have the same opportunity to acquire knowledge as those in developed areas. At the same time, it can also provide a more convenient learning experience for special learners such as those with visual impairments, physical disabilities, and deaf-mute. It can meet their learning needs through voice or text, enabling them to receive education equally. AIGC can provide equal learning guidance, answer learners' knowledge-based questions, or give targeted suggestions, and can alleviate the problem of insufficient teaching staff, especially in educationally underdeveloped areas. AIGC helps improve the comprehensive qualities and abilities of all students, making them more equal in the competition and development of future society. By providing diverse learning resources and personalized learning assistance, it helps students from different

backgrounds fully tap their potential. They can get a more balanced improvement in academic achievements, vocational skill training, and other aspects. Thus, it ensures the fairness of educational results to a greater extent (Ouyang et al., 2022), allowing learners to obtain similar development achievements and opportunities with their own efforts and abilities.

The Challenges of AIGC Technology in Educational Fairness
Digital technology is of great significance in enabling educational fairness. However, while enabling it, there may also be some ethical risks. Especially when the educational digital transformation is about to face more intelligent general large models, the ethical risks of educational fairness may be further intensified (Wiese et al., 2025). Although technology can share advanced concepts and excellent educational resources by technical means, in fact, the role of technology in improving the fairness of preschool educational opportunities is still limited. The teaching forms of AIGC technology that span time, space, modalities, and organizations can't have meaningful interactions well with cute children who lack information application abilities. Therefore, AIGC technology still faces many impossibilities in promoting the fairness of preschool educational opportunities at present. The observation point for whether technology can promote the fairness of higher education opportunities should be whether technology can help differentiated individuals obtain higher education opportunities with roughly the same quality and reputation fairly in the higher education system after receiving a fair basic education. In recent years, the development of AIGC is obvious to all, but the fairness of higher education opportunities has not continued to improve with the development of this technology.

At the same time, it is undeniable that while AIGC is narrowing the education gap, new gaps may also appear (Zi-yang, 2024). Therefore, when technology promotes learning, educational fairness is still an issue that educational stakeholders need to pay attention to (Zhang & Wasie, 2023). Research reports show that in some developing countries, low-income families cannot use basic Internet devices normally (Masfuah et al., 2021). A survey by the Southern Education Foundation on class and racial differences during the COVID-19 pandemic shows that nearly one-fifth of African American children and children from low-income families could not access the Internet at home (García & Weiss, 2020). However, the use of AIGC tools often depends on certain equipment and network conditions. There is a certain conflict between the resource-intensive characteristics of AIGC technology and the public welfare nature of education. The Matthew effect that the strong get stronger and the weak get weaker may occur, exacerbating the imbalance of educational resources. Schools in developed areas may find it easier to obtain and use AIGC technology, while schools in poor areas may face difficulties in accessing the technology and high usage costs. In terms of digital skills, the digital divide may also lead to new problems. Studies on the process of popularizing new technologies have found that people from advantaged socioeconomic backgrounds also have an advantage in exploring new information. This advantage is reflected in three aspects: accessing information, using information, and profiting from using information (Sipasulta et al., 2022). For example, teachers don't know how to set the parameters of AIGC to generate materials suitable for their teaching content. And this gap in digital skills makes differences in learners' improvement of learning effects with the help of AIGC, exacerbating educational unfairness.

Meanwhile, the content generated by AIGC may have problems with quality and accuracy, such as incorrect information and illogical content, which need to be manually reviewed and proofread. In addition, the modifiability of the model may also lead to security and privacy problems in the generated content (Wang et al., 2023). AIGC technology has brought unprecedented opportunities for the realization of educational fairness. By providing personalized learning support and increasing educational resources, it helps to narrow the educational gap between different regions and different groups. However, in the application process, technical limitations, new problems in resource allocation, and ethical risks need to be taken seriously and solved. AIGC may be more suitable for some students with certain learning styles or ability levels. For example, for students with stronger independent learning abilities, the personalized learning functions of AIGC may work better. But for those students who need more interpersonal interaction and direct guidance, AIGC may not be able to meet their needs, thus causing unfairness among different student groups when they use AIGC for learning.

Conclusion

Educational technology innovation requires the educational environment to adapt to learners and meet their needs. Technology plays a complicated role in promoting educational fairness. The issue of fairness is a top priority in developing education. We should ensure that everyone can enjoy the benefits of digitalization. Educational technology is having and will continue to have a profound impact on the field of education. It has broken the monopoly of high-quality education centered around excellent teachers.

AIGC technology has brought new hope for educational fairness. It has broken the geographical limitations of the traditional allocation of educational resources, enabling high-quality educational resources to cross spatial barriers and reach more learners in remote areas. This makes it more possible to achieve fairness at the starting point of education. In the process of education, its personalized learning support can provide customized learning paths and tutoring according to students' unique situations, which weakens the unfair influence caused by human factors such as differences in teaching staff to some extent.

Certainly, technology is important, but it is not omnipotent. We must clearly recognize the new problems caused by the application of technology. For example, in terms of resource allocation, developed areas can obtain and use AIGC technology more easily by virtue of their economic and technological advantages, while poor areas may be at a disadvantage due to shortcomings in equipment, network, and digital skills, resulting in a further widening of the educational gap. In addition, ethical issues such as the quality control of the content generated by AIGC and the protection of data security and privacy cannot be ignored. Educators should fully understand the two sides of AIGC technology and use it reasonably in teaching practice, making use of its advantages and avoiding its disadvantages. Meanwhile, educational policymakers also need to formulate corresponding regulations and support policies to ensure that technology can move forward steadily on the road to promote educational fairness.

Educational fairness has always been a hot topic in contemporary education. Education should keep pace with the times. To promote educational fairness, educational informatization is needed as a powerful means. It is related to many factors such as the investment in national education funds, the allocation of educational resources, and educational policies. This requires the joint efforts of all sectors of society. Only by achieving educational fairness can social fairness and harmonious development be promoted. The government should increase investment in the infrastructure construction of educational technology, especially support for economically underdeveloped areas. Educational institutions can actively carry out digital literacy training programs to improve the digital skill levels of teachers and students. At the same time, strict data management regulations and technical standards should be improved to ensure the data security and privacy in the application of AIGC technology. Only in this way can the positive effectiveness of AIGC technology in educational fairness be fully exerted and education be promoted to develop in a more fair and inclusive direction.

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