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Research on the Practical Dilemmas and Countermeasures of Artificial Intelligence Applications in Education

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Abstract: In recent years, artificial intelligence (AI) has rapidly evolved, triggering substantial transformations across various sectors. However, it has also spawned multiple dilemmas within the realm of education. These include technical challenges such as ambiguous division of labor between humans and machines and adaptation barriers for intelligent technologies, practical issues like disorder in smart educational spaces and the sense of alienation and detachment engendered by these technologies, and ethical quandaries such as the risk of information leakage for teachers and students, biased models leading to unfairness in intelligent education, among others. Consequently, at the technical level, there is an urgent need for top-down guidance from policy documents and a clearer demarcation of roles between humans and machines in the process of smart education. Practically, established teaching methodologies and technologies of the information age should not be discarded, and a conscious effort must be made to cultivate talent specialized in AI-assisted education. Ethically, the design of ethical guidelines for AI technologies is imperative, accompanied by rigorous verification of tool safety measures, to ensure that the integration of AI in education is not only innovative but also responsible and equitable.

Keywords: Artificial Intelligence; AI Applications In Education; Real Challenges; Response Strategies

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1.Introduction

Since the conference on How to Simulate Human Intelligence with Machines held at Dartmouth University in the 1960s, artificial intelligence has entered people's field of vision. After nearly 70 years of development, humanity has experienced several significant historical events. In 1997, the supercomputer "Deep Blue" defeated the world chess champion Garry Kasparov. In 2016, the artificial intelligence robot AlphaGo successively defeated Go champions Lee Sedol and Ke Jie. In October 2017, the intelligent robot Sophia was granted citizenship by Saudi Arabia. At the end of November 2022, the emergence of the generative artificial intelligence (ChatGPT) attracted worldwide attention, and its ability to automatically generate content exceeded people's expectations. Subsequently, Baidu's Wenyi, iFlytek's Xinghuo Cognition, Alibaba Cloud's Tongyi Qianwen, and Tencent's Hunyuan large model were launched one after another, triggering the "Battle of a Hundred Models". In September 2023, Ke Jie lost in the final to Xu Haorui, a Go player who specialized in playing against artificial intelligence to improve his skills. Netizens exclaimed in the comment section: "Human Go is dead, and artificial intelligence is about to dominate human society." In May 2024, OpenAI launched its new flagship model "GPT-4o". The "o" in GPT-4o stands for "omniscient", taking another step towards more natural human-computer interaction. The new

model enables ChatGPT to handle 50 different languages while improving speed and quality. Now, artificial intelligence has gradually become an all-purpose teacher for teaching human learning, and its identity role has been defined by multiple educational roles, such as tutor, teaching assistant, analyst, head teacher, and career planner [1]. However, there are still many problems in the process of applying artificial intelligence in education, such as technology, practice, and ethics, and effective strategies and suggestions are urgently needed.

2.Technical Dilemmas and Responses in the Educational Application of Artificial Intelligence

2.1 Technical Dilemmas Faced in the Educational Application of Artificial Intelligence

Firstly, the technical issue caused by unclear division of labor between humans and machines. In the traditional education system, teachers, as the leaders of all teaching and learning activities, hold an absolutely central position in the educational process. However, with the introduction of artificial intelligence into teaching, although its original intention was only to assist teaching, improve efficiency, and enhance personalized learning experiences, it has gradually led to significant conflicts between teachers and machines. For a time, whether teachers would be replaced by artificial intelligence became the focus of media attention. Some scholars have publicly predicted that "95% of teachers will be unemployed and there will be no need for teachers to conduct ordinary and worthless lectures and courses." Anthony Seldon, the headmaster of Wellington College, a famous British public school, also predicted that by 2027, machine teachers would replace human teachers [2]. However, some reports also point out that although the future elimination rate of personnel, customer service, government employees, accountants, and bank staff is all above 89%, the possibility of teachers being replaced by robots is only 0.4% [3]. Forbes, through a survey of 2,000 jobs, found that the most difficult jobs to automate are design management and talent development (with an automation potential of 9%), followed by jobs that require professional knowledge for decision-making, planning, and creativity (with an automation potential of 18%), and jobs that involve communication with customers, suppliers, and other stakeholders (with an automation potential of 20%) [4]. As possessors of in-depth professional knowledge, communicators who need to engage in complex interpersonal interactions, and leaders who carry out innovative talent development activities, teachers have a key spirit that is difficult to replace. Starting from whether intelligent robots can replace teachers, it further leads to the dispute over the teaching division of labor between machines and teachers. Some researchers believe that machines can free teachers from tedious, mechanical, and repetitive mental work, replace teachers to complete daily work such as grading homework, and empower teachers to become part of their work, with human-machine collaboration completing intelligent work that could not be done before. However, if teachers do not participate in homework grading at all, there will be a serious absence of teaching evaluation. They will not be able to pay attention to the learning status, needs, and individuality of each student from real homework, and it may also lead to students encountering the situation where the system may continuously generate errors but cannot be corrected in time during the process of autonomous dialogue with the machine, resulting in an aversion to the algorithm [5]. Therefore, the ambiguity of the division of labor between humans and machines has led to negative emotions such as hesitation, doubt, and even resistance among a large number of teachers in real educational fields. It is precisely because of this that teachers cannot trust artificial intelligence and have to regard it as a forbidden area, a mere decoration. At the same time, it is also because of the unclear division of labor between humans and machines, and the designers, developers, promoters, and maintainers of intelligent technology are limited by their own knowledge structure, way of thinking, and main life. They cannot promote the healthy development of intelligent education and build a complete structure [6].

Secondly, there is an adaptability barrier to intelligent technology. Education is a complex existence. The complexity of educators is reflected in the individual differences of ordinary individuals in terms of personality traits, character traits, emotional expression, thinking level, and other aspects, as well as differences in general knowledge, academic knowledge, ability, quality, methods, and other aspects. The complexity of the educated is reflected in talents such as language, music, painting, and self-acquired differences such as personality, thinking, interest, and motivation [7]. The introduction of artificial intelligence has once again extended the dimensions of the complexity of education in both horizontal and vertical directions. Horizontally, due to the uneven distribution of technological infrastructure, remote and resource-poor areas are prone to new

"island" phenomena. The "digital divide" between urban and remote rural areas has widened. Under the realistic constraints of relatively lagging infrastructure, teacher resources, and educational concepts, it is more difficult to effectively deploy and use intelligent tools [8]. Vertically, although intelligent technology has indeed developed rapidly in recent years, intelligent education often cannot and should not naturally follow the pace of intelligent technology development. On the one hand, the application of intelligent technology in the educational field needs to redeploy and plan its functions and roles. Survey data frequently confirms this view. Abroad, scholars have found that over the past 10 years, adaptive learning technology is still not mature enough in improving classroom education and other aspects [9]. In China, scholars have found through surveys in 28 cities (districts) of 12 provinces and 2,505 primary and secondary schools that their intelligent learning environment is still in its infancy. On the other hand, education should not drift with the development of intelligent technology. Humans have their own uses. The main reason why humans are different from other living beings is that they have activities such as morality, personality, soul, and spirit. So, how should humans enhance the adaptability of intelligent technology? The key is to improve the intelligent literacy of teachers and students, find relevant influencing factors, and establish an effective intelligent literacy and digital literacy framework to form a literacy development model that can be promoted, learned, and improved. For example, some scholars have found that positive attitudes, interest, and other factors are positively correlated with intelligent literacy [10]. However, there is still a lack of widely recognized intelligent literacy frameworks. Although the "Citizens' Digital Competence Framework" launched by the European Union is widely used in academia and industry, its content related to intelligent literacy still has problems of being vague and ambiguous [11].

2.2 Technical Design of Artificial Intelligence Educational Application

Firstly, seeking top-level design guidance from policy documents. In 2018, the Ministry of Education issued the "Opinions of the Central Committee of the Communist Party of China and the State Council on Comprehensively Deepening the Reform of Teacher Team Building in the New Era" [12], which proposed that "teachers should actively adapt to the new technological changes of informatization and artificial intelligence, and effectively carry out educational teaching." The "Education Informatization 2.0 Action Plan" [13] also proposed to launch the "Artificial Intelligence + Teacher Team Building Action" and emphasized the need to greatly improve teachers' information literacy. The "China Education Modernization 2035" proposes to "accelerate the training of new teachers who are proficient in applying information technology to adapt to the new technological changes of informatization and artificial intelligence" [14]. The "Guiding Opinions on Promoting the Construction of New Educational Infrastructure and Building a High-quality Education Support System" issued by six ministries and commissions clearly pointed out that "developing intelligent teaching applications based on artificial intelligence, such as intelligent teaching assistants and intelligent learning companions, to achieve 'co-teaching and co-education of humans and machines' and improve the quality of educational teaching" [15]. Now, with the emergence of generative artificial intelligence, there is an urgent need for relevant educators to formulate effective policy documents to support the application of generative artificial intelligence in educational teaching to achieve top-level leadership.

Secondly, refining the positioning of humans and machines in the process of intelligent education. In June 2023, the well-known global management consulting firm McKinsey & Company released its latest report "The Economic Potential of Generative Artificial Intelligence: The Next Frontier for Productivity" [16]. It provides a detailed analysis and prediction of the impact of generative AI on the economy and its disruption of future work. Between 2030 and 2060, 50% of current work activities may be replaced. The OECD's report shows that more than a quarter of jobs can be optimized by AI to improve work efficiency and easily achieve automation. Many people have begun to worry that they may lose their jobs due to artificial intelligence. The common predictions of many institutions indicate that some human jobs can be replaced by machines to a large extent. However, despite this, in the teacher-led classroom, the introduction of artificial intelligence should still be mainly designed to assist teachers in teaching and students in learning. It is not acceptable to leave the classroom empty, abandon teachers, and let machines run wild. On three levels, intelligent devices can be introduced in a limited way. First, batch grading of homework, based on the existing rapid grading of objective questions such as multiple-choice questions, strengthen the use of intelligent machines for evaluative activities in oral dialogue and text discussion. Second, provide a large number of intelligent teaching resources for learners to choose from. Through generative artificial

intelligence, achieve high-level human-machine dialogue and stay away from the new "information islands" of the artificial intelligence era. Third, realize large-scale personalized learning. Education stakeholders can easily access generative artificial intelligence to solve unique teaching problems.

3.Practical Dilemmas and Responses in the Educational Application of Artificial Intelligence

3.1 Practical Dilemmas Faced in the Educational Application of Artificial Intelligence

Firstly, there is a disorder in the space of intelligent education. The existence of space makes the development of things changeable. Artificial intelligence, through its functions of generating content and personalized recommendations, makes the logic of the development of things in the space of intelligent education more complex, diverse, and changeable. It can generate various types of multimodal educational resources and design various personalized intelligent learning paths. However, with the large-scale generation of content by artificial intelligence, there has also emerged technology based on machine learning, deep learning, and other algorithms that synthesizes human appearances and voices, creating a variety of highly realistic fake video content. This has caused confusion in the judgment and evaluation abilities of teachers and students, as well as a strong sense of concern for information security. At the same time, various educational information resource websites based on personalized recommendations will induce users to click on videos that already have a high number of clicks, creating a unique resource trap of the intelligent era. That is, are videos with a large number of clicks and views necessarily high-quality teaching resources? Perhaps teaching content that can better mobilize emotions, stimulate the five senses, and meet entertainment needs is more favored by algorithms [17]. Teaching resources based on personalized recommendations are not necessarily what students should learn, need to learn, or have to learn. They are more likely to be resources that make students feel more relaxed. In this way, students will find it even more difficult to step out of their "comfort zone" and move towards the "zone of proximal development." Therefore, although various intelligent platforms and tools are becoming more and more popular and can provide students with flexible and diverse learning paths, they also lead to problems such as fragmented learning environments, resource overload, information disorientation, and cognitive overload [18]. Secondly, teachers and students experience a sense of separation and alienation from intelligent technology [19]. Although intelligent tools can provide students with timely feedback and 24/7 learning support, and expand interaction channels [20], at the same time, intelligent tools may have problems such as insufficient teaching, poor feedback, and lack of perception [21]. Even worse, since intelligent interaction usually lacks knowledge depth and emotional warmth, the trust and understanding between teachers and students may be deeply weakened, leading to a sense of alienation from technology. Therefore, teachers are trying hard to adapt to new teaching methods with technology, but they lack sufficient training and support. It is difficult to ensure that in intelligent-assisted teaching activities, both the enthusiasm of students for autonomous intelligent exploration and the necessary teaching order can be maintained [22].

3.2 Practical Design of Artificial Intelligence Educational Application

At present, there are a large number of intelligent education-related conferences, activities, courses, and competitions. However, when we look closely at their specific content, there is often a lack of practical content about artificial intelligence. In the intelligent era, people are eager to use new technologies and tools to solve educational problems. However, they often lack practical methods. During the teaching practice process, a strange phenomenon has emerged: those who understand technology are afraid of teaching, and those who understand teaching are afraid of technology [23]. Therefore, it is urgent to design an effective path for intelligent education practice.

Firstly, we should not abandon the mature teaching methods and technologies of the information age. For example, teaching models such as STEM and BOPPPS, and educational means such as virtual reality and augmented reality. For example, STEM education is an educational approach that integrates science (Science), technology (Technology), engineering (Engineering), and mathematics (Mathematics). Science helps learners understand the world and explore the laws of nature. Technology and engineering, based on understanding the world, further use tools or methods to solve problems encountered in social development. Mathematics can serve as a basic subject tool for technology and engineering, helping people to abstract complex real-life problems. In the intelligent era, it is still necessary to be down-to-earth and focus on application.

It is not necessary to follow intelligent tools blindly, but to take solving real-life problems as the goal and comprehensively cultivate students' ability to solve problems.

Secondly, consciously cultivate talents in artificial intelligence teaching. In the "Notice of the State Council on Issuing the New Generation of Artificial Intelligence Development Plan," the keyword "talent" appears 34 times [24]. Although it is not possible or necessary for all teachers to become artificial intelligence experts, they can strive to become experts in artificial intelligence education, understand the basic concepts and logic of artificial intelligence, and be able to use artificial intelligence to design teaching. At least, the following three aspects of content can be learned: (1) Basic concepts of artificial intelligence, including what artificial intelligence is and an introduction to concepts such as machine learning, deep learning, and intelligent algorithms; (2) Implementation technologies of artificial intelligence, including concepts and implementations related to knowledge graphs, search technology, swarm intelligence algorithms, machine learning, artificial neural networks and deep learning, expert systems, computer vision, natural language processing, speech processing, planning, and multi-agent systems; (3) Ethical considerations of artificial intelligence, exploring the relationship between humans and machines from a technological philosophy perspective.

4.Ethical Dilemmas and Responses in the Educational Application of Artificial Intelligence

4.1 Ethical Dilemmas Faced in the Educational Application of Artificial Intelligence

Firstly, there is a risk of information leakage among teachers and students. News such as "Over a thousand university websites at risk of information leakage [25]" and "170 million student information records leaked? [26]" has directly caused widespread panic among teachers and students. With the wide application of various intelligent platforms, the basic personal information of teachers and students, as well as data related to teaching and learning, are collected and analyzed. Teachers and students may unknowingly and unconsciously have their privacy information, such as facial expressions and physiological signals, stolen. For example, information leakage can occur due to unencrypted storage, security vulnerabilities in data transmission, and non-strict third-party sharing agreements. Scholars have conducted a systematic review, analyzing 73 sample documents and 23 related national policy documents, and found that in the process of intelligent education, data types are complex, privacy protection levels vary, and there are difficulties in multi-platform data interaction and risks of leakage during centralized training [27]. Since the data of teachers and students is stolen, it is easy to encounter major problems such as information fraud and malicious tampering with learning records.

Secondly, model bias leads to unfairness in intelligent education. Since intelligent algorithms need to be "fed" with historical data for learning, any social bias embedded in the data may be infinitely amplified by the algorithm. For example, learning recommendation systems based on historical data may inadvertently exacerbate stereotypes of certain groups and limit their learning opportunities. This bias may stem from incomplete available databases, lack of widely accepted "data standards," inability to disclose or access certain sensitive or confidential information due to privacy regulations or ethical issues, institutional barriers to data sharing or publication, and unbalanced datasets [28]. It is this algorithmic bias that further affects key decisions such as student assessment and resource allocation. For example, if the performance records of a certain type of student are insufficient in the training set, the intelligent system may incorrectly underestimate the capabilities of that group, leading to unequal learning opportunities. Scholars have conducted a systematic review of 57 articles related to algorithmic bias in educational artificial intelligence from 2013 to 2023 and found a variety of issues such as algorithmic bias, algorithmic discrimination, algorithmic black box, and information cocoons [29]. Therefore, it is necessary to strictly consider and examine the awareness, understanding, and behavior of relevant educators regarding algorithmic fairness to avoid exacerbating unfairness in intelligent education. For example, scholars have found that different types of algorithms have varying degrees of gender bias, such as collaborative filtering algorithms and ranking algorithms. Designers, decision-makers, users, and maintainers of intelligent technology may consciously or unconsciously embed their biases into intelligent systems [30]. For example, elite robots managing businesses are often depicted as male, while submissive service robots are often depicted as female.

4.2 Ethical Design of Artificial Intelligence Educational Application

To promote the goodness of technology and humanity, ethical issues in artificial intelligence education must be given importance in the field of education. In fact, the development of artificial intelligence originates from human development, and artificial intelligence stems from human intelligence. During the training of artificial intelligence, it is inevitable that human thoughts, concepts, and even biases and discrimination will be implanted. Therefore, it is essential to pay attention to intelligent ethics.

Firstly, design the ethics of artificial intelligence technology. Norbert Wiener [31], the father of cybernetics, mentioned in "The Human Use of Human Beings" that the trend of machine development is to surpass and replace humans in all aspects, not just in energy and strength. The famous theoretical physicist Stephen Hawking, in an interview with the BBC in 2014, proposed that "the development of full artificial intelligence could spell the end of the human race." After nearly 70 years of development, artificial intelligence has gone through several stages, including initial development, reflective development, application development, low development, steady development, and rapid development. It is now in an exponential development phase. Therefore, while humans can still control artificial intelligence, how to design the ethics of artificial intelligence technology is at a critical historical juncture [32][33]. The futurist Ray Kurzweil mentioned in "The Singularity Is Near" that once a certain singularity is exceeded, humans may be completely overwhelmed by artificial intelligence. Against this backdrop, it is possible to draw on and follow the ethical design model of artificial intelligence proposed by Wallach and Allen: (1) Top-down, by imposing clear rule constraints on machines; (2) Bottom-up, by requiring machines to learn morality on their own and achieve self-evolution; (3) Hybrid, by allowing machines to acquire some rules while also permitting them to make modifications. At the same time, accelerating the development of the human brain is an important way for humans to enhance themselves and flexibly design the ethics of artificial intelligence technology. According to research, the brain of the famous physicist Albert Einstein was only developed by 10%, and most ordinary people's brain utilization is only 3%. The left hemisphere of the human brain is responsible for logical and orderly thinking, while the right hemisphere is engaged in imaginative thinking and is the source of creativity, also inspiring artistic thought.

Secondly, ensure the safety of tools. One of the most significant concerns humans have about artificial intelligence currently is its uncertain safety. Many existing technologies serve as "extensions" for humans and are within human control. For example, refrigerators can preserve food, high-speed trains facilitate travel, and elevators assist in moving between floors. However, the development of artificial intelligence exhibits a degree of uncertainty that is somewhat similar to "cloning organisms," both of which may pose risks beyond human control. Elon Musk, the creator of Tesla, once said, "Developing artificial intelligence is like summoning the devil; every wizard who claims to be able to control the devil will fail." During the development of artificial intelligence, potential changes in the technology itself, hacker intrusions, and viral infections could all cause significant disruptions. Therefore, humans should always maintain the ability to constrain machines, resolve their internal contradictions, establish moral standards for machines, control whether machines take actions, and manage the biases of artificial intelligence. Based on these capabilities, adjust intelligent ethics according to actual circumstances.

5.Conclusion

Upon reflection on the application of artificial intelligence in education, it is evident that there still exist technical dilemmas such as unclear division of labor between humans and machines and adaptability barriers to intelligent technology. There are also practical challenges like disorder in the space of intelligent education and a sense of separation and alienation from intelligent technology. Additionally, ethical issues such as the risk of information leakage among teachers and students and model bias leading to unfairness in intelligent education persist. Therefore, in the future, there is an urgent need to design strategies for the application of artificial intelligence in education from three aspects: technology, practice, and ethics. In terms of technology, there is an urgent need to seek top-level design guidance from policy documents and to refine the positioning of humans and machines in the process of intelligent education. In terms of practice, it is essential not to abandon the mature teaching methods and technologies of the information age and to consciously cultivate talents in artificial intelligence teaching. In terms of ethics, it is necessary to design the ethics of artificial intelligence technology and ensure the safety of tools.

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