

Ethical Dilemmas in the Application of Artificial Intelligence in Education: Manifestations, Causes, and Solutions

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ABSTRACT: While artificial intelligence empowers education by breaking through time and space constraints and building adaptive platforms, it also triggers ethical risks such as the weakening of the subjectivity of teachers and students, a lack of humanistic care, algorithmic black boxes, and regulatory vacuums. This study analyzes the causes of these dilemmas, pointing out that the cognitive limitations and lagging role transition of teachers and students, the deviation between technical logic and educational goals, and the asynchronicity in the construction of institutional norms are the root causes of the aforementioned ethical dilemmas. To this end, the paper proposes strategies such as enhancing the digital literacy of teachers and students, reshaping the human-oriented value orientation of technology, and perfecting the institutional norms system. These measures aim to build a benign ecosystem of human-machine collaboration and promote the high-quality development of the application of artificial intelligence in education.

KEYWORDS: Application of Artificial Intelligence in Education, Ethical Dilemmas, Solutions

1. INTRODUCTION

Artificial intelligence (AI), with its efficient data processing capabilities, intelligent decision-making abilities, and personalized service capabilities, has become an important engine driving innovation and development in education in the era of digital intelligence [1]. The 2017 New Generation Artificial Intelligence Development Plan issued by the State Council emphasized the importance of applying artificial intelligence to the field of education. Furthermore, the Ministry of Education's Key Points of Work for 2025 stated the need to continuously advance the national education digitalization strategy. The deep integration of artificial intelligence and education has reshaped the educational ecology and teaching models [2]. Smart education is playing an increasingly significant role in China's education system and has become the trend of future educational development.

However, the ethical issues arising from the application of artificial intelligence in education—such as privacy leakage, algorithmic bias, impairment of educational equity, and the loss of subjectivity—have also generated profound negative effects [3]. These issues will undermine the fairness and trust of the educational ecology, exacerbate the digital divide and social stratification, lead to technological alienation eroding humanistic care, and weaken the fundamental educational essence of cultivating people [4]. This study attempts to propose solutions to these ethical dilemmas by deeply analyzing the causes of the ethical challenges in the application of artificial intelligence in education, thereby promoting the sustainable development of artificial intelligence in empowering education.

2. ETHICAL DILEMMAS BROUGHT BY THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN EDUCATION

Currently, the major ethical dilemmas facing the application of artificial intelligence in education in China manifest as: the weakening of the subjectivity of educational subjects, algorithmic bias, privacy leakage and data security risks, and the impairment of educational equity.

2.1 The weakening of the subjectivity of educational subjects

Human subjectivity, characterized by autonomy, agency, and creativity developed through the interaction between the subject and the object, is a crucial goal for education to achieve. As artificial intelligence technology gradually becomes an important teaching tool, teachers and students form intersubjectivity based on mutual respect. However, the logic of technology may deviate from individual intentions, producing counter-subjectivity effects [5]. Excessive instrumental rationality will gradually weaken human

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subjectivity, causing it to become objectified; at the educational level, this leads to teachers and students becoming subordinated to machines [6].

First, the subjectivity of students is weakened. The application of artificial intelligence in education has enabled the personalized customization of students' learning content and provided targeted feedback on learning outcomes. However, under the technological bias of artificial intelligence, the selectability of students' learning content gradually narrows under algorithmic prediction, the frequency of independent thinking and deep inquiry decreases, and individual subjectivity continues to weaken [7], which is detrimental to students broadening their horizons and achieving sustainable development.

Second, the subjectivity of teachers is weakened. Driven by the application of artificial intelligence in education, some teachers, due to a lack of technical proficiency, are not yet adapted to the role transition of using artificial intelligence as a teaching assistant. Some teachers even relinquish their primary status in teaching to intelligent machine teachers due to an over-reliance on artificial intelligence technology, reducing themselves to invisible people in the educational field [8]. Meanwhile, as students mostly have personal preferences, those who are deeply dependent on the intelligent learning resources provided by artificial intelligence may overlook the leading role of teachers in instructional activities.

Third, the teacher-student relationship is gradually becoming estranged. Artificial intelligence technology can directly and clearly statistically analyze and provide feedback on teachers' classroom effectiveness and students' homework. However, based on the humanistic view of education, the interaction modes of intelligent systems rely on preset programs and cannot touch the inner spiritual world of learners. Cyberspace restricts direct dialogue between teachers and students, which is unfavorable for face-to-face knowledge exchange and emotional interaction. When the educational process is excessively dominated by technology, the interaction between teachers and students is simplified into data instructions, and teaching increasingly becomes formalized and homogenized.

2.2 Algorithmic bias

Algorithmic bias arising from the application of artificial intelligence in education refers to the phenomenon where intelligent systems produce non-objective and non-neutral results when processing educational data due to biases in training data, flaws in algorithmic model design, or the subjective value orientations of developers. This results in unfair treatment of specific groups. It is not merely a neutral malfunction of the technology itself, but a digital amplification of existing social inequalities [9].

It primarily manifests in two aspects: first, the distortion of academic evaluation and prediction. If the training data is primarily derived from advantaged groups, the system often tends to overestimate the developmental potential of high-achieving students while overlooking the progress of disadvantaged students, or even make predictions that fall below actual capabilities for students from specific regions, genders, or races. Second, the inequitable distribution and recommendation of educational resources. Intelligent recommendation systems may, based on students' labels, continuously push advanced knowledge to excellent students while repeatedly pushing basic content to poor-performing students, thereby exacerbating the digital divide. Additionally, certain enrollment or screening algorithms may implicitly exclude students from specific backgrounds.

Such bias generates severe adverse impacts: it directly undermines educational equity, inflicts invisible discrimination upon students, and stifles the developmental motivation and self-confidence of students from disadvantaged groups. Furthermore, by creating a self-fulfilling prophecy, it continuously misdirects and restricts students' horizons and learning habits, leading to rigid thinking. In the long run, this will also cause a further imbalance in the allocation of educational resources, violating the original intention of education to promote the comprehensive development of human beings.

2.3 Privacy leakage and data security risks

As artificial intelligence deeply integrates into the entire educational process, privacy leakage and data security risks have become the most prominent ethical challenges. The root cause lies in the profound contradiction between the logic of efficiency pursued by technology and individual privacy rights [10]. In order to achieve precise academic analysis, personalized tutoring, and learning path prediction, intelligent systems not only collect students' enrollment and performance data, but also comprehensively and imperceptibly collect students' biometric and emotional states through technologies such as facial recognition, eye tracking, and behavior capture. This normalized panoramic surveillance and high-frequency data scraping blur the boundaries between public educational spaces and private life domains. It places students under the gaze of the algorithm, generating a psychological anxiety of being monitored, which seriously erodes their psychological safety boundaries and ability for autonomous perception. It also makes the right to informed consent difficult to truly implement in the face of complex technical black boxes.

Even more severe is the fact that many schools and educational institutions have not yet established sound mechanisms for data privacy protection and full-lifecycle management [11]. Consequently, the storage and circulation of massive amounts of sensitive data from teachers and students are in a high-risk state. Due to a lack of effective firewalls and encryption measures, this high-value educational information is highly susceptible to theft by commercial entities or even criminals. In recent years, data leakage incidents caused by internal management oversight have occurred frequently, reducing the personal information of teachers and students to bargaining chips for illegal transactions. This has further spawned a series of malicious criminal cases, such as precise telecommunications fraud and extortion. This not only directly threatens the property safety and physical and mental well-

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being of teachers and students but also triggers a widespread crisis of trust at the societal level. It leads parents and students to develop a rejection psychology towards AI education applications, ultimately hindering the healthy advancement and sustainable development of the education digitalization strategy.

2.4 The impairment of educational equity

The impairment of educational equity is a profound ethical challenge faced by the application of artificial intelligence in education. This issue transcends the mere availability of technological access and is concentrated in complex dimensions such as the structural imbalance of resource allocation, the fairness of educational outcomes, and the social sharing of technology costs. Theoretically, artificial intelligence should promote the global sharing of high-quality resources by breaking down time and space barriers, thereby bridging the traditional education gap. However, in reality, the realization of equity is highly constrained by the degree of improvement in network infrastructure, intelligent terminal configuration, and the digital ecosystem. Impoverished and underdeveloped regions, restricted by funding shortages, possess natural disadvantages in hardware construction, computing power deployment, and platform maintenance. Consequently, before the existing digital divide has been filled, a new intelligent divide has already formed. This makes it difficult for the technological dividends to benefit the groups most in need, instead exacerbating resource barriers [12].

Although at the current national macro level, regional disparities in the application of artificial intelligence in education are not yet significant—primarily because the overall digital-intelligence transformation is still in its infancy, with both the breadth and depth of technology application awaiting further exploration—as technology iterates and deepens, the Matthew Effect in educational development will become increasingly pronounced. Advantaged regions, relying on strong financial resources and technological accumulation, are able to utilize AI to construct self-adaptive, personalized, and precise teaching systems, thereby significantly improving teaching efficiency. In contrast, resource-scarce regions may fall into low-technology lock-in due to technological lag, leading to a rapid widening of the gap in educational quality between regions. Furthermore, the intervention of technology capital often follows the logic of market profit-seeking, easily leading to the concentration of resources in top-tier schools, while marginal groups are further neglected by algorithmic screening mechanisms. This cognitive and practical fault line caused by uneven technical infrastructure and differences in service accessibility not only fails to achieve educational inclusiveness but also silently reinforces class stratification, seriously hindering the substantive advancement of educational equity.

3. ANALYSIS OF THE CAUSES OF ETHICAL DILEMMAS IN THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN EDUCATION

Given the complexity of the aforementioned ethical dilemmas, this paper will conduct an analysis from three dimensions—subjective cognition, technological logic, and the institutional environment—in order to clarify the internal logic and root causes underlying the formation of these dilemmas.

3.1 Limitations in subjective cognition and lagging role transition exacerbate ethical risks

As core participants in educational activities, the cognitive literacy and role adaptability of students and teachers directly determine the boundaries of human-machine collaboration [13]. However, current cognitive limitations and lagging transitions at the subjective level have become key factors inducing ethical risks.

Firstly, the limitations in students' metacognitive abilities lead to technological dependency and cognitive bias. Students' information processing capabilities are still in a developmental stage; when faced with realistic content generated by deep synthesis technologies or information recommended by algorithms, they often lack the ability for critical examination and can easily fall into cognitive misconceptions or suffer from information misguidance. Meanwhile, excessive reliance on artificial intelligence to obtain answers can result in mental inertia. This form of technological outsourcing causes students to lose their spirit of independent thinking and academic inquiry, gradually reducing them to appendages of the system. Furthermore, the information cocoon effect of personalized recommendations may solidify students' thinking patterns, hindering the development of their interdisciplinary perspectives and comprehensive cognition.

Secondly, the lagging transition of teachers' roles leads to improper teaching decision-making. The intervention of artificial intelligence forces teachers to transition from embodied knowledge authorities to human-machine collaborative guides, but this process often lags behind technological development. On one hand, the marginalization of their status as knowledge authorities triggers professional anxiety and psychological rejection in some teachers, causing them to underestimate the potential of technology or even develop resistance. On the other hand, a lack of technological literacy and integration capability leads teachers to only engage in superficial technical stacking when facing intelligent platforms, making it difficult to achieve deep integration and innovation. Under the dual effects of psychological rejection and unfamiliarity with skills, teachers cannot accurately grasp the scale of technology application. Consequently, artificial intelligence easily becomes a formalized display tool, or even reduces the quality of education due to improper teaching decisions.

3.2 Deviation of technological logic from educational goals leads to ethical misconduct

The application of artificial intelligence in education is highly technology-intensive, yet there is an inherent tension between the efficiency-priority attribute of technological logic and the value rationality of educational nurturing [14]. The simplification of the educational process by technology, the dislocation of subjective goals, and the embedding of developers' biases collectively lead to the emergence of deep ethical dilemmas.

On one hand, the simplification and quantification of technological logic strip away the humanistic connotations of education. Education is essentially a dynamic process containing emotional interaction, cognitive training, and value shaping. However, technological development tends to simplify this complex process into quantifiable data nodes. This data reductionism not only fails to capture the tacit knowledge in education but also causes the quantitative stripping of the spiritual connotations of teachers and students. Technicians often prioritize technique over pedagogy during design, neglecting humanistic factors such as teacher-student relationships, subjective status, and psychological states that are difficult to quantify. This neglect of the spiritual characteristics of the educational object makes it difficult for technological products to carry social humanistic values, and even exacerbates decision-making risks and the absence of emotional ethics due to the unexplainability of the algorithmic black box.

On the other hand, the conflict of subjective goals and the embedding of implicit biases cause value deviation. In the educational field, teachers and students, as users, have core demands to use artificial intelligence to promote the comprehensive development and physical and mental health of students. Technicians, as developers, on the other hand, focus more on overcoming technical problems, optimizing tool efficiency, and maximizing utility. This dislocation in objective functions between the development side and the user side leads technical products to often cater to instrumental rationality at the expense of the value rationality of education. Furthermore, artificial intelligence technology is not value-neutral; the training data of deep learning models inevitably carries the cultural presuppositions and value positions of developers. When technicians lack a profound understanding of the essence of educational nurturing, their unconscious biases are implanted into educational scenarios along with the system. Superimposed with algorithmic bias, this erodes educational equity and poses potential threats to the formation of students' values.

3.3 Asynchronicity of institutional norms triggers regulatory vacuums and ambiguity in responsibility ethics

Against the backdrop of the rapid expansion of artificial intelligence in education, the construction of the existing institutional norms system exhibits obvious asynchronicity [15]. The insufficiency of institutional supply has led to a double dilemma of regulatory vacuums and unclear attribution of responsibility.

Firstly, the absence of top-level design leads to ethical misconduct and regulatory failure. Currently, the design and development of artificial intelligence education applications have not yet established a universal ethical framework, and there is a lack of unified mandatory norms for key links such as data acquisition, information maintenance, and accountability. Given the rapid iteration of artificial intelligence technology, whereas traditional regulatory models often conduct static reviews based on established rules, it is difficult to adapt to the dynamic evolution of technology. The lag in updating regulatory mechanisms behind technological innovation makes it difficult for institutions to promptly follow up on safety and compliance assessments. They cannot effectively foresee potential risks such as algorithmic bias and privacy leakage, increasing the difficulty of ethical governance.

Secondly, the complexity of multi-subject participation leads to blurred boundaries of rights and responsibilities. The decision-making process of artificial intelligence intertwines the behaviors of multiple parties, including teachers, students, and technicians, all of whom are in a state of bounded rationality. In practical application, once algorithmic discrimination or decision-making errors occur, it often falls into a tragedy of the commons regarding responsibility due to a lack of clear legal definitions. Technicians may use technical neutrality as an excuse to evade ethical scrutiny, while teachers and students find it difficult to claim rights due to the technical black box. This lack of clarity in the attribution of rights and responsibilities seriously weakens the sense of ethical responsibility of various subjects in the process of development and application.

Finally, the dislocation between universal research and development (R&D) and localized needs exacerbates ethical risks. The current R&D market tends to favor universal development for broad groups, lacking precise matching for the actual needs of specific regions or groups. This one-size-fits-all model may not only lead to data bias and the failure of personalized guidance but also generates new inequities in cross-cultural and cross-regional applications. Differences in values, cultural backgrounds, and physiological characteristics (such as the applicability of human sensing devices) among different countries and regions make it difficult for globally unified knowledge sharing and technical standards to meet the rights and interests of all student groups, further highlighting the lag and powerlessness of institutional norms in responding to differentiated ethical demands.

4. SOLUTIONS TO THE ETHICAL DILEMMAS IN THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN EDUCATION

Faced with the aforementioned ethical challenges, this paper follows the logical path of causal analysis to collaborate across three dimensions: enhancing the subjects' digital literacy, reshaping the value orientation of technology, and perfecting the institutional norms system. By constructing a comprehensive set of response strategies, we aim to promote the healthy development of the application of artificial intelligence in education.

4.1 Enhancing subject digital literacy and reshaping the teacher-student relationship of human-machine collaboration

Addressing the issues of cognitive limitations and the lagging role transition of teachers and students, the fundamental strategy lies in empowering teachers and students through education and training to enhance their subjectivity and adaptability in intelligent environments.

Firstly, strengthening students' metacognitive abilities and critical thinking. Education should go beyond the mere teaching of technical tool usage and incorporate the cultivation of algorithmic critical awareness and information discrimination capabilities into the core competency system [16]. Schools need to offer relevant courses or lectures to help students deeply understand the technical principles and limitations of artificial intelligence, guiding them to discern the authenticity of deep synthesis content and break the superstition of technological omnipotence. At the same time, education on intellectual property and information ethics should be strengthened so that students can consciously regulate their behavior when using AI tools, avoiding mental inertia and cognitive misconceptions, and truly becoming masters of technology rather than its appendages.

Secondly, promoting the role transition of teachers and the deep integration of technology. A comprehensive intelligent education training system should be established to help teachers overcome psychological fear and cognitive dissonance regarding technology, facilitating their transition from knowledge transmitters to designers and guides of human-machine collaboration [17]. Training should not stop at the operational level but should focus on improving teachers' abilities to evaluate the effects of digital learning and integrate technological resources for curriculum innovation. By enhancing teachers' technological literacy, they will be able to accurately grasp the scale of human-machine collaboration, make scientific teaching decisions, and use artificial intelligence to stimulate students' deep thinking rather than merely as a display tool.

4.2 Reshaping the value orientation of technology and constructing human-centered development ethics

In response to the deviation of technological logic from educational goals and the lack of humanistic care, educational ethics must be implanted at the source of technological development to ensure that technological evolution always serves the comprehensive development of human beings [18].

On one hand, establishing the technical development principle of education presence. Technicians need to break the single-minded thinking of technical rationality and actively involve education experts, frontline teachers, and psychologists in the entire research and development process to achieve interdisciplinary collaboration. In terms of design philosophy, the tendency of reductionism that simplifies the educational process into cold data should be abandoned; instead, attention should be paid to implicit factors that are difficult to quantify, such as teacher-student emotional interaction and psychological states. By introducing ethical norms specific to the education field, it is ensured that algorithmic models not only focus on efficiency improvement but also align with the nurturing essence of education, avoiding decision-making risks brought about by algorithmic black boxes.

On the other hand, implementing whole-process algorithm auditing and bias correction. Technology developers must face the fact that technology is not value-neutral and establish strict data cleaning and algorithm review mechanisms. In the data acquisition stage, the diversity and representativeness of samples should be ensured to prevent social historical biases from being implanted into the model; in the model training and application stage, explainable artificial intelligence technology needs to be introduced to open the algorithmic black box and make the decision-making logic transparent. At the same time, an ethical evaluation committee should be established to conduct normalized monitoring of generated content, filtering information containing implicit discrimination or distorted values in a timely manner, ensuring that technology application conforms to mainstream social moral standards.

4.3 Perfecting the institutional norms system to fill the governance vacuum of dynamic regulation

Addressing the problems of asynchronicity in the construction of institutional norms and ambiguity in responsibility attribution, there is an urgent need to build an agile legal regulatory system that adapts to technological iteration to clarify the boundaries of rights and responsibilities of all parties [19].

Firstly, establishing dynamically adaptive ethical norms, laws, and regulations. Top-level design should keep pace with technological progress, formulating ethical frameworks and mandatory standards specifically for the application of artificial intelligence in education. Key focus should be placed on regulating critical links such as data acquisition, privacy protection, and algorithm accountability, clarifying the rights of informed consent and the right to be forgotten regarding data usage. Meanwhile, the regulatory model should shift from static pre-approval to dynamic process regulation, utilizing technological means to conduct real-time monitoring and risk early warning of algorithms, thereby improving the flexibility and effectiveness of regulation.

Secondly, building a multi-party collaborative governance mechanism and a clear chain of responsibility. Breaking the convention of using technical neutrality as an excuse for exemption, the laws should clearly define the rights and obligations of technicians, educational institutions, teachers, students, and other parties. A clear responsibility tracing mechanism should be established for ethical accidents caused by algorithmic discrimination or decision-making errors to prevent a tragedy of the commons regarding responsibility. Furthermore, considering regional and cultural differences, the development of implementation rules adapted to localized needs should be encouraged while following general ethical standards. This ensures that the educational rights and interests of different groups are fairly safeguarded, achieving the refinement and humanization of technology governance.

5. CONCLUSION

This study suggests that the ethical dilemmas in the application of artificial intelligence in education are rooted in the limitations of educational subject cognition, the deviation between technological development logic and educational goals, and the asynchronous construction of institutional norms. Specifically, the weakening of subjectivity and cognitive solidification among teachers and students due to technological dependence; The design concept of "emphasizing technology over education" in education has led to a lack of humanistic care and algorithmic black box risks, resulting in the continuous loss of educational equity due to regulatory vacuum and ambiguous rights and responsibilities.

In response to these deep-seated causes, this paper constructs a Subject-Technology-Institution trinity governance path. First, by enhancing the digital literacy and role adaptability of teachers and students, the human-machine collaborative relationship is reshaped to effectively address the cognitive limitations of subjects. Second, the value orientation of technological development is reshaped by strengthening human-oriented design principles and whole-process algorithm auditing to correct the misalignment between technical logic and educational goals. Finally, the institutional norms system is perfected by establishing dynamic and agile regulatory mechanisms and clear chains of responsibility to fill governance vacuums.

In an era where machine anthropomorphism is deepening, while artificial intelligence has greatly promoted educational reform and integration, it must never come at the cost of sacrificing the essence of education. Only by adhering to the dynamic balance between instrumental rationality and value rationality, by enhancing the subjects' ability to reflect and master technology, by disciplining the ethical dimension of technology, and by constructing a rigorous institutional defense line, can we avoid the risks of algorithmic alienation. This will enable artificial intelligence technology to truly return to the authenticity of education and empower the comprehensive development of human beings.

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