REVIEW

The Ethical Challenges of Educational Artificial Intelligence and Coping Measures: A Discussion in the Context of the 2024 World Digital Education Conference

Hong Chen

Epson (China) Co., Ltd., Beijing 100000, China

***Abstract**: Artificial intelligence (AI), as the core technology of the fourth industrial revolution, has been widely deployed in many areas, bringing tremendous changes to human society. At the same time, AI has also instigated a variety of ethical issues regarding basic human rights, social order, private safety, and more. In order to maintain a balance between technological development and the ethics of AI, governments of various countries and international organizations are working to develop AI regulations and ethical norms. A forum themed "Artificial Intelligence and Digital Ethics" was held as a side event during the 2024 World Digital Education Conference (WDEC), showcasing the Chinese government's adherence to the ethical notion of "human-centered AI" and the principle of "digital for good" in using AI in digital education. The forum emphasized the importance of establishing the ethics of educational AI for circumventing relevant ethical risks and creating healthy environments for the digital transformation of education. Based on the forum's theme, this article seeks to set forth the necessity of formulating a code of ethical norms for educational AI and to explore pathways to building an ethical framework in this regard in order to provide insights into the rational application of AI in education and promote the sustainable development of digital education.*

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About the Author*: Hong Chen, Epson (China) Co., Ltd., Beijing 100000, China, E-mail: chen.hong@ecc.epson.com.cn*

Correspondence to*: Hong Chen at Epson (China) Co., Ltd of China.*

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Introduction

ARTIFICIAL INTELLIGENCE (AI), a central technology in the fourth industrial revolution, is widely used in numerous facets of human life and brings ongoing transformative changes to society (Feng, 2022). The widespread application of AI and its deep integration into fields like education, health care, finance, communication, and media have substantially increased society's productivity and economic outcomes. Viewing AI as the focus of international competition, major countries around the world have formulated their own strategy for the development of AI to enhance their national competitiveness (Chen & Zhu, 2024).

However, AI-induced ethical risks related to issues such as basic human rights and social order have the potential to bring about immense threats to society (Feng & Zang, 2024). AI ethics, as a component of technological ethics, is currently high on the agenda of science and technology development governance in many countries. In January 2020, the US federal government released the "Regulation Guidelines for Artificial Intelligence Applications" to guide the federal government's regulatory and non-regulatory measures for AI development and application (Zhu et al., 2023). The European Union initiated its effort to build a regulatory framework for the application of AI technology in 2016. In 2018, it created the High-Level Expert Group on Artificial Intelligence to accelerate the establishment of a unified legal regulatory framework for AI. In June 2023, the European Parliament enacted the draft compromise amendment of the Artificial Intelligence Act, marking the EU's leading position in AI regulation in the world. (Ning et al., 2023). UNESCO's "Recommendation on the Ethics of Artificial Intelligence," released in 2021, is the first international paper to regulate AI ethics globally. It affirms that AI ethics should prioritize the protection of human rights, freedoms, and dignity as a core value (Zhu & Hu, 2022).

AI is an important driving force for educational development. The majority of countries in the world place a high premium on the application of AI in education. The US's report titled "Preparing for the Future of Artificial Intelligence" emphasizes that AI development has increased the social demand for high-level talents, and intelligent applications have become a key focus of the strategy of strengthening educational foundations (Executive Office of the President, National Science and Technology Council Committee on Technology, 2016). The report "Growing the Artificial Intelligence Industry in the UK" calls for an expansion of the AI-specialized talent pool as a national strategy (Hall & Pesenti, 2017). In Germany's "High-Tech Strategy 2025 Progress Report," AI technology is described as a "future weapon" for heightening national competitiveness and educational innovation (Federal Ministry of Education and Research, 2019). According to UNESCO's *Rethinking Education: Towards a "Global Common Good,"*

crucial to the sustainable and healthy development of educational AI are creating intelligent learning settings and personalized learning paradigms, improving evaluation systems, and providing scientific education management and services (UNESCO, 2017).

Educational AI has also garnered wide attention in China. In January 2024, the Ministry of Education of China, the Chinese National Commission for UNESCO, and the Shanghai Municipal People's Government jointly organized the 2024 World Digital Education Conference (WDEC) with the theme of "Digital Education: Application, Sharing, and Innovation." Its six forums focus on the topics of the improvement of teacher digital literacy and competence; the building of digital education and a learning society; the evaluation of global trends and indices in digital education development; artificial intelligence and digital ethics; the challenges and opportunities of digital transformation for basic education; and the digitalization of education governance and digital education governance, respectively (Ministry of Education, 2024a). Outstanding among them is the forum on "artificial intelligence and digital ethics." Based on the forum's theme, this article explains the necessity of formulating a code of ethical norms for educational AI and discusses the pathways to building a framework of ethics in this regard in order to provide insights into the rational application of AI in education and promote the sustainable development of digital education.

Ethical Challenges of AI in Education

AI is developing at an unprecedented pace because of the maturation of technologies such as cloud computing, big data, virtual reality, and deep learning. AI applications continue to integrate into all facets of society, causing profound changes in human production and life. The developmental trend of AI shows that its impact on education is increasingly intensifying (Li et al., 2018). According to Huai (2024), the Minister of Education of China, in today's world characterized by accelerating technological and industrial revolutions, digital technology has increasingly become a driving force that fundamentally changes and reshapes human society's thinking patterns, organizational structures, and operational modes on all fronts. Education faces both new challenges and opportunities. Every country is contemplating the epochal question of "where education is headed."

With its intelligent, automated, and high-precision data analysis and processing capabilities, educational AI can empower teaching and learning in many ways, such as simulating the roles of teachers, administrators, peers, partners, and competitors to promote communication and collaboration (VizcainoI, 2004); providing students with adaptive learning support services by assisting in building adaptive learning environments and analyzing and diagnosing the learning style and needs of students (Luckin, 2016); helping stu-

dents formulate right answers to questions by utilizing natural language processing and deep learning technologies (Guo et al., 2019); identifying learners' emotional needs in the learning process and providing tailored emotional support by automatically recognizing their body movements and facial expressions using the affection detection technology (Saneiro et al., 2014); giving students feedback that suit their cognitive levels by automatically evaluating their learning outcomes (Perikos et al. 2017); supporting teachers in making teaching decisions and learners in making learning decisions through decision-making management technology (Luckin et al., 2016).

Despite its value in data integration and analytics, educational AI elicits a wide variety of ethical concerns, such as the challenge to the traditional role of teachers, deviation from student holistic development, academic misconduct due to technological abuse, and security infringement induced by data leakage. Therefore, it is imperative to thoroughly examine the ethical complexities arising in the design, development, and application of educational AI and to make careful considerations about what ethical principles should be followed to ensure a legitimate use of AI in education (Deng & Li, 2020).

Challenging Teachers' Role as Educators

AI has reformed the traditional education ecosystem, enabling AI-powered robots to now fulfill instructional duties that were previously exclusive to teachers. The history of AI application in education displays that AI's educational functions have undergone significant changes throughout various developmental stages. Older-generation intelligent instructional applications such as SOPHIE, MYCIN, and GUIDON played the roles of tutors, trainers, and evaluators in training and teaching, capable of making decisions and giving directions based on disciplinary knowledge and existing experience. New-generation AI applications, such as LearnSmart, Knewton Platform, Squirrel AI Adaptive Learning, AI Teaching Assistant Jill Watson, MIT's Tega Robot, Anki's Cozmo Robot, and robotic trainer Alpha 2, can play more sophisticated educational roles in intelligent tutoring, question paper setting, Q&A, evaluation, and other teaching tasks (Feng et al., 2020). Newly developed intelligent robots and intelligent search engines have become effective assistants and companions of students in their autonomous inquiry-based learning and cooperative learning, and some of them can even function as emotional support and digital entertainment (Wang, 2021). The trend toward AI outperforming human educators in certain instructional behaviors is growing.

Nevertheless, teachers' responsibilities go far beyond knowledge imparting; teaching entails more complex and higher-order duties, such as moral character and value education and social education (Hao, 2022). Con-

cerns such as "whether educational AI is capable of making correct moral or value-related judgments," "whether it will entirely replace teachers," and "if it can assist students in developing social and emotional skills to prepare them for future social integration" remain unanswered. When AI assumes increased roles as educators, the traditional ethics of education will be put to the test.

Impeding Student Holistic Development

Tailored teaching, as opposed to mass teaching, is the notion of education that students should be taught with varied objectives and approaches according to their differential foundations, competences, interests, and personality traits. It is of vital significance for supporting students' holistic development and cultivating creative talents for the new era (Yan, 2021). However, in the context of AI applications in education, excessive personalized "push and customization" could potentially impede the comprehensive development of students.

In the process of educational innovation and reform, the educational community seeks to harness technological applications to realize tailored education. The implementation of student-personalized learning has become a key component of educational AI. Personalized learning applications, such as intelligent virtual assistants, mentor systems, and adaptive learning systems, are all developed based on the individual characteristics of learners' languages, learning styles, preferences, etc. (Yang et al., 2018). These applications, powered by big data analytics and recommendation algorithms, can help realize mass personalized learning by adjusting course difficulty according to students' learning abilities, adapting learning materials to suit each learner's progress in real-time, and providing tailored exercises at the appropriate time (Jin et al., 2017).

Nevertheless, AI-assisted tailored instruction does not necessarily contribute to holistic student development. Educational AI based on big data analytics can decompose human knowledge into computable digital symbols and effectively track and analyze students' learning behavior and process. Personalized recommendation algorithms can easily cause the "information cocoons" effect (Wang, 2023). Based on the algorithmic push, the content presented to students is what suits the students' interests or preferences as a result of the filtration and selection by technology. Over time, students' learning interests and attention may be constrained within a predetermined range, their knowledge horizons may be narrowed, the inclusiveness and diversity of learning content may be compromised, and their thinking may be manipulated by algorithms (Ma, 2022). Moreover, students' overreliance on recommendation algorithm-dominated information acquisition can easily lead to their behavioral and thinking inertia; their initiative in learning will

be impaired by technology (Feng et al., 2020). All these factors are detrimental to students' all-round development.

In addition, educational AI based on machine learning and recommendation algorithms has the potential hazards of information discrimination and bias, which are often implicit or covert under the illusion of personalized learning (Hu, 2021). When technology becomes a new form of totalitarianism, humans either conform to the work procedures prescribed by technology or they become appendages to technological tools (Zhou, 2007). The plurality of ethical risks associated with AI applications in education is noteworthy.

Threatening Data Privacy

The right to privacy is crucial to the protection of human dignity, autonomy, and agency. Data privacy refers to individuals' claims that data about them generated in the processes of information collection, storage, use, and transmission should not be accessible to other individuals and organizations. Data privacy aims to prevent unauthorized abuse or public disclosure of personal information (Du, 2017). Amidst the rapid development of educational AI, privacy infringement and data leakage emerge, posing grave threats to the security of teachers' and students' personal information.

Environmental information can also be gathered and recorded in educational settings, in addition to personal features like the fingerprint, face, and voice being used in determining user identity. In Raja Yusof et al.'s (2017) study, a positioning system and a learning behavior visualization system that could monitor student classroom activities in real-time were developed and applied to 132 teachers and students. The temperature, humidity, and carbon dioxide concentration in the classroom may affect the learning efficacy of teachers and students, as well as their physical health. In response to this concern, Peng and Chen (2017) developed a real-time monitoring system for the classroom environment based on Bluetooth. In addition, intelligent sports devices such as the smart wristband and intelligent lung capacity assessment tool can be used to collect students' health data, and consequently, problems with physical fitness and sports ability in students may also be revealed (Yu, 2020). The proper use of the aforementioned information can support the enhancement of educational services; nevertheless, without adequate protection, the large amounts of personal information controlled by intelligent systems may risk leakage, and the exploitation of said information for certain illegal purposes can lead to privacy infringement.

Inciting Academic Misconduct

Academic misconduct is an attempt by a student to gain, or help others gain, an unfair academic advantage (University of Cambridge, 2019), including but not limited to plagiarism, cheating, collusion, and the use of unauthorized aids during a test or exam. When misused, AI technology can facilitate academic misconduct.

AI technologies, such as ChatGPT, can be used to produce persuasive and logical texts in response to the user's requirements, making AI-generated paper, automatic plagiarism, and the fabrication of data possible (Luo & Ma, 2023). In the meantime, students' overreliance on AI technology and undiscriminated acceptance of its offerings may lead to cognitive laziness and thus deteriorate their academic competence. Even worse, the prevalence of using mobile devices as cheating tools has grown. In Ikanth's and Asmatulu's (2014) study, 70% of the student participants admitted to using various high-tech devices in examinations, group assignments, reports, and paper writing. To better serve their educational purposes, the developers of educational AI applications must consider how to avoid ethical risks in their products.

Pathways to the Establishment of Ethics in Educational AI

All stakeholders in education are subject to the ethical hazards of AI technologies, which could be latent, chronic, and irreversible. To ensure effective governance of AI applications in education and prevent technological abuse, it is imperative to establish ethical norms that inform the development and use of educational AI (Feng et al., 2020).

Jie Chen, Vice Minister of Education of China and Director of the National Committee of UNESCO, emphasized at the 2024 WDEC that the expedited advancement of digital technology has brought forth unprecedented challenges and opportunities for global education, profoundly changing educational ideas, models, and paradigms. The Chinese government places great stress on the governance of digital education, adhering to the principle of maintaining balances between AI development and security and between AI innovation and moral considerations. The establishment of the digital education expert council committee and AI ethics committee and the formulation of regulation frameworks for educational AI are underway to meet the challenges of AI applications in education (China Youth Daily, 2024).

In the process of integrating AI in education, it is important to clarify the moral limitations of AI applications in regular instruction, scientific research, and social services, as well as formulate industry standards, governance regulations, and ethical norms for educational AI in order for AI to con-

tribute to a safe, efficient, and sustainable development of education (People.cn, 2024b). Imperative among various pathways to the establishment of the ethics of educational AI are ascertaining their goals and principles, strengthening the governance of educational AI, and enhancing the AI literacy of teachers and students.

Ascertaining Educational AI Ethics Goals and Principles

Goals of Ethics in Educational AI

The explicit goals of educational AI ethics provide directions for the effort in this regard. Establishing the ethics of educational AI is aimed at safeguarding human rights and educational equity, supporting sustainable development of education, cultivating responsible users of technology, and promoting the coordinated development of technological innovation and ethics for a healthy, orderly, and sustainable development of educational AI.

Safeguard Human Rights and Educational Equity: To ensure that the application of AI technology in education does not infringe on human rights to privacy, personal data security, and equitable education; to ensure that all students have equal access to the educational resources and opportunities brought about by AI technology (Xiao, 2023).

Support Sustainable Development: To align the advancement of educational AI with the goals of sustainable development in society as a whole; to contribute to the equity of quality education and promote lifelong learning (Tao, 2023).

Coordinate the Development of Technological Innovation and Ethics: To encourage innovation in educational AI within the framework of AI ethics; to promote parallel advancements of technology and ethics to drive the ongoing progress of education (Deng, 2024).

Cultivate Responsible Users of Technology: To educate teachers and students to become responsible users of technology; to affirm the ethical principles and norms in the use of AI technology to prevent abuse and misuse of technology (Wu et al., 2024).

Principles for the Ethics of Educational AI

To guide the ethical use of social networking sites, Parrish (2010) developed a model of ethical principles named PAPA, which stands for information privacy, accuracy, property, and accessibility. Using this model as a framework of reference, Du et al. (2019) put forward ethical principles of educational AI, highlighting responsibility and accountability, privacy protection,

impartiality, transparency, non-maleficence, precaution, and reliability of systems in the adoption of AI in education.

Responsibility and Accountability: AI actors, especially developers and deployers of educational intelligent systems, must fulfill their responsibilities and obligations under specific laws and regulations.

Privacy Protection: Individuals in the educational community should be able to access, manage, and control personal data processed by intelligent machines to prevent unauthorized sharing of user information with other individuals or businesses.

Impartiality: Training algorithms with inaccurate or biased data produces biased outcomes, leading to algorithmic discrimination. AI should avoid making decisions that are systematically unfair to certain groups of people in the realm of education.

Transparency: Factors that influence the decisions made by algorithms should be visible, or transparent, to stakeholders in education who use and regulate the systems that employ those algorithms.

Non-maleficence: This principle emphasizes that algorithms should "do no harm," which entails not infringing the privacy of teachers and students and avoiding misuse of AI technologies in other ways. There must be mechanisms in place to prevent harm from the unforeseen behavior of machines.

Precaution: There should be systems to oversee the behavior of machines and corresponding warning devices, which enable users of AI technology to react promptly when machines engage in behaviors that harm humans.

Reliability of Systems: This principle concerns algorithmic systems' stability and consistency. AI systems should have reliable features such as safe operation and the capability of avoiding being maliciously manipulated.

Enhancing Ethical Issue Governance with Educational AI

Human-machine collaboration is becoming increasingly popular in educational settings. It brings about new challenges for the educational community, both technologically and ethically, requiring AI governance based on specialized legislation, regulations, and policies, which is the precondition for deep, orderly, and healthy integration of AI in education (Xia et al., 2023). Ethics connect moral norms and the law, and the ethics of educational AI need to be institutionalized by a series of conventions, policies, and rules (Xu, 2023). **Table 1** exhibits global efforts to address ethical issues in the development and application of AI technology.

Table 1. Papers on AI Ethics Issued by Major Countries and International Organizations.

Names	Years	Issuers
Recommendation on the Ethics of Artificial Intelligence (UNESCO, 2021)	2021	The United Nations
Responsible AI: A Global Policy Framework (ITechLaw, 2021)	2021	ITechLaw
The Roman Call for AI Ethics (RenAIssance Foundation, 2020)	2020	Italy
Principled Artificial Intelligence: Mapping Consensus in Ethical and Rights-based Approaches to Principles for AI (Berkman Klein Center for Internet & Society, 2020)	2020	Berkman Klein Center of Harvard University
AI Principles: Recommendations on the Ethical Use of Artificial Intelligence by the Department of Defense (Defense Innovation Board, 2019)	2019	The U. S.
Principles for the Governance of New-Generation AI: Developing Responsible AI (Fu & Cai, 2019)	2019	China
Recommendation of the Council on Artificial Intelligence (OECD, 2019)	2019	OECD
Communication: Building Trust in Human Centric Artificial Intelligence (European Commission, 2019)	2019	European Commission
Artificial Intelligence: Australia's Ethics Framework (Australian Government, 2019).	2019	Australia
IEEE AI Ethics and Governance Standards (IEEE, 2019)	2019	IEEE SA
AAAI Code of Professional Ethics and Conduct (Association for the Advancement of Artificial Intelligence, 2019).	2019	AAAI
Social Principles of Human-Centric AI (Cabinet Secretariate of Japan, 2019)	2019	Japan

These official papers include a wide range of ethical principles for AI, such as agency and supervision, privacy and security, social and environmental well-being, and responsibility and accountability. Each paper has its own focus. Among them, UNESCO's "Recommendation on the Ethics of Artificial Intelligence" puts forth the most principles, including sustainability, fairness and non-discrimination, transparency and explainability, awareness and literacy, etc. The OECD's "Recommendation of the Council on Artificial Intelligence" highlights as principles for responsible stewardship of trustworthy AI: inclusive growth, sustainable development, and well-being; human-centered values and fairness; transparency and explainability; robustness, security, and safety; and accountability (OECD, 2019).

Amid the widespread use of AI in education, major countries and international organizations have actively advanced their governance of ethical issues associated with educational AI. For example, the Australian Government Department of Education sponsored research on AI and school education, which resulted in "*Artificial intelligence and emerging technologies (virtual, augmented, and mixed reality) in schools: A research report"* (Southgate et al., 2019). UNESCO released the reports "Beijing Consensus: Artificial Intelligence and Education" (Ministry of Education of China, 2019) and "Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development" (UNESCO, 2019) as part of the outcomes of the

Table 2. Papers on AI Ethics Issued by the Chinese Government.

Names	Years	Key Points
The Strategy for the Development of New-Generation Artificial Intelligence (State Council of China, 2017)	2017	Increase financial and policy backing and formulate state-level overall plans for AI development.
The Three-Year Action Plan for Promoting the Development of New-Generation Artificial Intelligence Industry (2018-2020) (Ministry of Industry and Information Technology of China, 2017).	2017	Accelerate the development of AI industry; drive the deep integration of AI and the real economy.
Guidelines for the Construction of National New-Generation Artificial Intelligence Innovation and Development Pilot Zones (Ministry of Science and Technology of China, 2017).	2020	Support the construction of new-generation AI innovation and development pilot zones to address major issues in AI research and industry; build healthy ecology for better AI development
The 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and Long-Range Goals 2035 (State Council of China, 2021)	2021	Formulate strategic scientific plans and programs for fundamental, core areas associated with the national security and development; Initiate a number of forward-looking and strategic nation-level major scientific and technological projects in cutting-edge fields such as AI, quantum information, integrated circuits, life and health, neuroscience, biological breeding, aerospace technology, and deep ocean exploration, etc.
Opinions on Strengthening the Comprehensive Governance of Internet-based Information Service and Algorithms (State Council of China, 2021).	2021	Develop governance and supervision mechanisms for algorism security and advance algorism innovation for a trustworthy, high-quality, and orderly development of algorism, to support the construction of a nation with strong cyber power.
A Code of Ethics for New-Generation Artificial Intelligence (Ministry of Science and Technology of China, 2021).	2021	Set forth basic ethical norms for AI as well as rules for AI application regulation, research and development, supply, and use.
Regulations on the Management of Internet-based Information Service and Recommendation Algorithms (State Council of China, 2012).	2022	Regulate Internet-based information service and recommendation algorithms; safeguard national security and public interests; protect the rights of individuals and organizations to data safety to promote healthy development of information services.

International Conference on Artificial Intelligence and Education. The University of Buckingham's Institute for Ethical AI in Education released "The Ethical Framework for AI in Education" in 2021 (University of Buckingham, 2021). These papers set forth both overarching goals and concrete content on the ethics of educational AI.

China has the advantages of economies of scale, colossal volumes of data, and complete infrastructure for developing its Internet-based industries. The Chinese government places high importance on the development of AI technology and has issued a series of policies to strengthen the governance of AI security (**Table 2**).

These papers mark the Chinese government's commitment to the governance of ethical issues with AI. Despite the fact that there is no special-

ized government paper on educational AI in China, the exploration of building an ethical framework for it is underway. The 2024 WDEC marks a starting point in this regard. In his keynote speech at the forum on "artificial intelligence and digital ethics," Vice Minister of Education Guangyan Wang reaffirmed the Chinese government's adherence to the ethical notion of "human-centric AI" and the principle of "digital for good" in harnessing AI in digital education and emphasized the importance of establishing the ethics of educational AI for circumventing relevant ethical risks and creating healthy environments for the digital transformation of education (People.cn, 2024a).

Enhancing AI Literacy in Teachers and Students

At the 2024 WDEC closing ceremony, the "Shanghai Call for Cooperation on Digital Education" was released as an outcome document. Under the heading of "cooperation on promoting teachers' capacity building," it is advocated to "popularize inclusive and effective digitalized pedagogies, develop smart teacher assistants, explore digitalized collaborative teaching and research and human-machine collaboration, support teachers in becoming knowledge producers, learning facilitators, and development mentors, and improve teachers' digital competency" (Ministry of Education of China, 2024b). The teacher still plays unique roles in student growth and development despite the growing trend of human-machine collaboration in digital education. AI cannot replace teachers, whereas digitally competent teachers may replace those who are digitally incompetent (Yu, 2020).

It is critical for teachers to develop rational attitudes toward the concern that AI technology may threaten their jobs. They can reap the benefits of AI and, in the meantime, navigate the ethical challenges of integrating AI into instruction. Intelligent machines may assist teachers by reducing the number of easy and repetitive tasks they had to complete by themselves in the past, allowing them to dedicate more time and effort to activities of greater instructional value. As a result, they can better meet students' needs for emotional communication, morality and character development, and mental health education (Zhang, 2023).

Effective human-machine collaboration depends on improving teachers' digital competence. Enhanced AI literacy is beneficial for the teacher to better harness the advantages of machines and their own merits. The "Digital Literacy of Teachers" released by the Ministry of Education in December 2022 proposes a framework for teacher digital literacy, which includes digital awareness, digital technology foundation and intelligence, digital application, digital social responsibility, and professional development (Ministry of Education of China, 2022). Meeting the aforementioned criteria necessitates relevant digital training. According to the 2022 Blue Book on Artificial In-

telligence Education, the lack of systematic AI training for frontline primary and secondary teachers ranks as the second factor contributing to teachers' difficulty using AI applications in teaching. It also stresses the importance of increasing teachers' awareness of AI ethics in response to the ethical challenges of the adoption of AI technology in education and teaching (AAIED, 2023).

In the context of expedited knowledge updating in the AI era, students must have the ability to learn autonomously to keep up with the advancements of the time. Strengthening digital literacy can help them do so. Digital literacy entails not only basic IT knowledge but, more importantly, the competency to successfully process, analyze, and utilize information (Zhang & Fu, 2001). In the AI era, information has become the most important resource, and students with strong digital competence can be more efficient in finding valuable content in oceans of information to support their learning. Nevertheless, excessive dependence on technology may impair students' independent and critical thinking abilities; "information cocoons" as a consequence of intelligent recommendation impede their access to more comprehensive and diverse information (Zhang, 2023). Therefore, it is imperative to incorporate AI ethics education into student digital literacy training.

Conclusion

The use of AI in education has generated substantial benefits by increasing the breadth and depth of information flow, while at the same time, the ethical hazards associated with it have become a key concern of the educational community. Global efforts have been made to establish ethical norms for educational AI in a bid to safeguard the values of human rights and dignity. China is making its own contribution to the construction of the ethics of educational AI, which is evidenced by its hosting of the debate on this issue at the 2024 WDEC. The international education community aims to determine paths for advancing educational AI while upholding ethical and moral standards to benefit society as a whole.

References

AAIED. (2023). 2022 Blue Book of Artificial Intelligence Education. Available at: https://www.xdyanbao.com/doc/tcxbvold0z?bd_vid=9108871657894766515

Association for the Advancement of Artificial Intelligence (2019). AAAI Code of Pro-

fessional Ethics and Conduct. Available at: https://www.aaai.org/Conferences/code-of-ethics-and-conduct.php.

Australian Government. (2019). Artificial Intelligence: Australia's Ethics Framework. Available at: https://www.industry.gov.au/data-and-publications/australias-artificial-intelligence-ethics-framework/australias-ai-ethics-principles

Berkman Klein Center for Internet & Society. (2020). Principled artificial intelligence: mapping consensus in ethical and rights-based approaches to principles for AI. Available at: https://dash.harvard.edh/handle/1/42160420

Cabinet Secretariate of Japan. (2019). Social Principles of Human-Centric AI. Available at: https://www.cas.go.jp/jp/seisaku/jinkouchinou/pdf/humancentricai.pdf

Chen, D. & Zhu, X. (2024). Risks and regulation: International experience in building a framework of ethics of artificial intelligence. *Journal of Comparative Education*, 2024(1):72-83. Available at: https://kns.cnki.net/kcms2/article/abstract?v=-0THPtfOh1r0rIx9UtpSzeXHmPxhKW7-FnWkIFGLcVxEKKoWEk23tNs_69JJ1mK5OL3Lu4R5yW5hYnuRwLgn2LEBBTK0BbcZg3yHOAdKMc_q71PKuR5trQY4BOPNWI&uniplatform=NZKPT&language=CHS

China Youth Daily. (2024, February 1). A special report on the 2024 World Digital Education Conference. Available at: http://paper.jyb.cn/zgjyb/html/2024-02/01/content_635100.htm?div=-1

Defense Innovation Board. (2019). AI principles: Recommendations on the ethical use of artificial intelligence by the department of defense. Available at: https://media.defense.gov/2019/Oct/31/2002204458/-1/-1/0/DIB_AI_PRINCIPLES_PRIMARY_DOCUMENT.PDF

Deng, G. & Li, M. (2020). Ethical issues and principles of educational artificial intelligence. *E-education Research*, 2020(6):39-45. DOI: https://doi.org/10.13811/j.cnki.eer.2020.06.06

Deng, Y., Xu, H., & Wang, S. (2024). Governance of artificial intelligence risks: Models, tools, and strategies. *Reform*, 2024(1):144-158. Available at: https://kns.cnki.net/kcms2/article/abstract?v=-0THPtfOh3TJ9f8A3KgtJkfCNO9Av4ULpPJt1FvW4vRCFJQyBu2aLdaAMtBfr-FYuO2fYoLtiIqAWzo5ywn0phxqKp0b4mJ7e05N-NZ2EtRtjo9hwrcgICLstslM&uniplatform=NZKPT&language=CHS

Du, J., Huang, R., Li, Z., Zhou, W., & Tian, Y. (2019). The connotations and construction of ethics of artificial intelligence in the era of intelligent education. *E-education Research*, 40(7):21-29. DOI: https://doi.org/10.13811/j.cnki.eer.2019.07.003

Du, P. (2017). Conflicts between Trade Secret Protection and Personal Information Protection in Network User Personal Information Databases and Coordination Measures (master's thesis). East China University of Political Science and Law. Available at: https://kns.cnki.net/kcms2/article/abstract?v=-0THPtfOh15zzSiwXrQaAywtJMGylyLgmNWONlpH2OHHgVUzDcg7YxEe6dagbPePXpkmhEGoykvuZfvYTBWu66SxdeGNLc2PIw3czdbRxGAc2Sc7L5Zpnzab5IuUOK1LZLT1fD9FVe25QyHsg5LA==uniplatform=NZKPTlanguage=CHS

European Commission. (2019). Communication: Building Trust in Human Centric Artificial Intelligence. Available at: https://digital-strategy.ec.europa.eu/en/library/communication-building-trust-human-centric-artificial-intelligence

Executive Office of the President National Science and Technology Council Committee on Technology. (2016). Preparing for the future of artificial intelligence. Available at: https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf

Federal Ministry of Education and Research. (2019). The High-tech Strategy 2025 Progress Report. Available at: https://www.hightech-strategie.de/SharedDocs/Publikationen/de/hightech/pdf/the-high-tech-strategy-2025-progress-report.pdf?__blob=publicationFile&v=3

Feng, J. (2022). Ethical Risks of Artificial Intel-

ligence Technology (master's thesis). Northwest Normal University. DOI: https://doi.org/10.27410/d.cnki.gxbfu.2022.001040

Feng, R., Sun, J., & Sun, F. (2020). Ethical risks and rational choices of artificial intelligence applications in education. *Journal of Distance Education*, 2020(3):47-54. DOI: https://doi.org/10.15881/j.cnki.cn33-1304/g4.2020.03.005

Feng, Y. & Zang, Y. (2024). Moral myths in the era of artificial intelligence and countermeasures (J/OL). Jiangsu Social Sciences. DOI: https://doi.org/10.13858/j.cnki.cn32-1312/c.202240201.004

Fu, W. & Cai, D. (2019, June 17). Principles for the Governance of New-Generation AI: Developing Responsible AI. China Daily. Available from: http://cn.chinadaily.com.cn/A/201906/17/WS5d07441ea3108375f8f2afac.html

Guo, T., Peng, M., Yi, M., Mao, W., Hu, X., & Wei, G. (2019). The research progress on automatic question answering in the area of natural language processing. *Journal of Wuhan University (Science Edition)*, 65(5):417-426.

Hall, D. W. & Pesenti, J. (2017). Growing the Artificial Intelligence Industry in the UK. Available at: https://assets.publishing.service.gov.uk/media/5a824465e5274a2e87dc2079/Growing_the_artificial_intelligence_industry_in_the_UK.pdf

Hao, G. (2022). Alienation and Recovery of Academic Identity of Contemporary Chinese University Teachers (doctoral dissertation). Sichuan Normal University. DOI: https://doi.org/10.27347/d.cnki.gssdu.2022.000001

Hu, X. (2021). Algorithmism and Its Ethical Critique (doctoral dissertation). Hunan Normal University. DOI: https://doi.org/10.27137/d.cnki.ghusu.2021.001713

Huai, J. (2024). Promoting Jointly Application, Sharing and Innovation of Digital Education. Available at: http://en.moe.gov.cn/features/2024WorldDigitalEducationConference/KeynoteSpeech/202402/t20240201_1113771.html

Ikanth, M. & Asmatulu, R. (2014). Modern cheating techniques, their adverse effects on engineering education and preventions. *International Journal of Mechanical Engineering Education*, 42(2):129-140. DOI: http://dx.doi.org/10.7227/ijmee.0005

Institute of Electrical and Electronics. (2019). IEEE AI Ethics and Governance Standards. Available at: https://ethicsinaction.ieee.org/?utm_campaign=EAD1e&utm_medium=alias&utm_source=LI&utm_content=report

ITechLaw. (2021). Responsible AI: A global policy framework. Available at: https://www.itechlaw.org/ResponsibleAI2021

Jin, H., Hu, Y., & Song, L. (2017). Technology-supported educational innovation: Interpretation of Horizon Report (2017 Higher Education Edition) by the New Media Alliance. *Journal of Distance Education*, 2017(2):3-8. DOI: https://doi.org/10.15881/j.cnki.cn33-1304/g4.2017.02.001

Li, D., Ma, N., & Qin, K. (2018). Education in the intelligent era. *Research in Higher Education of Engineering*, 2018(5):5-10.

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence Unleashed: An argument for AI in Education. London: Pearson Education.

Luo, F. & Ma, Y. (2023). The Impact of AI-generated content on academic ecology and countermeasures: Based on an analysis of ChatGPT. *Modern Educational Technology*, 33(6):15-25. Available at: https://www.zhangqiaokeyan.com/academic-journal-cn_modern-educational-technology_thesis/02012101394556.html

Ma, X. (2022). Construction and Application of an Evaluation Index System for Teacher-Student Interaction in Smart Classrooms (doctoral dissertation). Northeastern Normal University. DOI: https://doi.org/10.27011/d.cnki.gdbsu.2022.001739

Ministry of Education of China. (2019). "Beijing Consensus - Artificial Intelligence and Education" officially released by the UNESCO as an outcome report of the International Conference on Artificial Intelligence and Education: Available at: http://www.moe.gov.cn/jyb_xwfb/gzdt_gzdt/s5987/201908/t20190828_396185.html

Ministry of Education of China. (2022). Notice on Issuing "Digital Literacy of Teachers." Available at: http://www.moe.gov.cn/srcsite/A16/s3342/202302/t20230214_1044634.Html

Ministry of Education of China. (2024a). Intro-

duction to the 2024 World Digital Education Conference. Available at: http://www.moe.gov.cn/jyb_xwfb/xw_zt/moe_357/2024/2024_zt02/

Ministry of Education of China. (2024b). The Shanghai Call for Cooperation on Digital Education. Available at: http://en.moe.gov.cn/features/2024WorldDigitalEducationConference/ShanghaiInitiative/202401/t20240131_1113637.html

Ministry of Industry and Information Technology of China. (2017). The Three-Year Action Plan for Promoting the Development of New-Generation Artificial Intelligence Industry (2018-2020). Available at: https://www.miit.gov.cn/zwgk/zcwj/wjfb/zh/art/2020/art_de90191568e94fb0b358864d30c67ae9.html

Ministry of Science and Technology of China. (2017). Guidelines for the Construction of National New-Generation Artificial Intelligence Innovation and Development Pilot Zones. Available at: https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/fgzc/gfxwj/gfxwj2020/202012/t20201224_171987.html

Ministry of Science and Technology of China. (2021). A Code of Ethics for New- Generation Artificial Intelligence. https://www.safea.gov.cn/kjbgz/202109/t20210926_177063.html

Ning, X., Wu, H., Chen, L., Wu, R., & Dong, F. (2023). A Review and Implications of the EU's AI Governance and Regulation Framework in the context of the transformation of global AI Governance. Available at: https://www.kwm.com/cn/zh/insights/latest-thinking/eu-artificial-intelligence-governance-and-regulatory-framework.html

OECD. (2019). Recommendation of the Council on Artificial Intelligence. Available at: https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449

Parrish, J.L. (2010). PAPA knows best: Principles for the ethical sharing of information on social networking sites. *Ethics and Information Technology*, 12:187-193. DOI: https://doi.org/10.1007/s10676-010-9219-5

Peng, K. & Chen, J. (2017). A classroom environment monitoring system based on Bluetooth. *Electronic Science & Technology*, 30(2):123-129. DOI: https://doi.org/10.16180/j.cnki.issn1007-7820.2017.02.032

People.cn. (2024a). The forum on "Artificial Intelligence and Digital Ethics" on sidelines of the 2024 World Digital Education Conference. Available at: http://edu.china.com.cn/2024-02/01/content_116978690.shtml

People.cn. (2024b). The initiative of "Empowering Education Development with Artificial Intelligence" announced at the 2024 World Digital Education Conference. Available at: https://edu.yunnan.cn/system/2024/01/31/032930479.shtm

Perikos, I., Grivokostopoulou, F. & Hatzilygeroudis, I. (2017). Assistance and Feedback Mechanism in an Intelligent Tutoring System for Teaching Conversion of Natural Language into Logic. *International Journal of Artificial Intelligence in Education*, 27(3): 475-514. DOI: https://doi.org/10.1007/s40593-017-0139-y

Raja Yusof, R. J., Qazi, A., & Inayat, I. (2017). Real-time student visualization system in classroom using RFID based on UTAUT model. *International Journal of Information and Teaching Technology*, 34(3):274-288. DOI: http://dx.doi.org/10.1108/ijilt-03-2017-0018

RenAIssance Foundation. (2020). The Roman Call for AI Ethics. Available at: https://www.romecall.org/the-call/

Saneiro, M., Santos, O. C., Salmeron-Majadas, S., & Boticario, J. G. (2014). Towards emotion detection in educational scenarios from facial expressions and body movements through multimodal approaches. *The Scientific World Journal*, 2014:484873. DOI: https://doi.org/10.1155/2014/484873

Southgate, E., Blackmore, K., Pieschl, S., Grimes, S., McGuire, J. & Smithers, K. (2018). Artificial intelligence and emerging technologies (virtual, augmented and mixed reality) in schools: A research report. Newcastle: University of Newcastle, Australia.

State Council of China. (2017). The Strategy for the Development of New-Generation Artificial Intelligence. Available at: https://www.gov.cn/xinwen/2017-07/20/content_5212064.htm

State Council of China. (2021). The 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and Long-Range Goals 2035.

Available at: https://www.gov.cn/xinwen/2021-03/13/content_5592681.htm

State Council of China. (2021). Opinions on Strengthening the Comprehensive Governance of Internet-based Information Service and Algorithms. Available at: https://www.gov.cn/zhengce/zhengceku/2021-09/30/content_5640398.htm

State Council of China. (2012). Regulations on the Management of Internet-based Information Service and Recommendation Algorithms. Available at: https://www.gov.cn/xinwen/2022-01/04/content_5666387.htm

Tao, S. (2023). Ethical Issues and Governance of Artificial Intelligence (master's thesis). Shenyang Normal University. Available at: https://link.cnki.net/doi/10.27328/d.cnki.gshsc.2023.000039

UNESCO. (2017). Rethinking Education: Towards a "Global Common Good"? (Chinese translation by UNESCO). Beijing: Education Science Press. Available at: https://kns.cnki.net/kcms2/article/abstract?v=-0THPtfOh2YJi1qwVq7ViLNngQ8Nhv5Z1nvk4_WOlYUMUuk6SM5u7139bPkXzCWW1tBps3zovPyd7Q5BepkKxM5uKbfPUpSji6_ubgziIj6Vmf5rbuO64w3Xp6WAx6oN4TSFrkNA=&uniplatform=NZKPT&language=CHS

UNESCO. (2019). Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000366994

UNESCO. (2021). Recommendation on the ethics of artificial intelligence. Available at: https://en.unesco.org/artificial-intelligence/ethics

University of Buckingham. (2021). The Ethical Framework for AI in Education. Available at: https://www.buckingham.ac.uk/wp-content/uploads/2021/03/The-Institute-for-Ethical-AI-in-Education-The-Ethical-Framework-for-AI-in-Education.pdf

University of Cambridge. (2019). Definition of academic misconduct. Available at: https://www.plagiarism.admin.cam.ac.uk/definition

Vizcaíno, A. (2004). A simulated student agent for improving collaborative learning. *Interactive Technology and Smart Education*, 1(2):119-126. DOI: https://doi.org/10.1108/17415650480000017

Wang, G. (2021). Liberation of Humans under the Backdrop of Artificial Intelligence Technology (doctoral dissertation). Central Party School of the Communist Party of China. DOI: https://doi.org/10.27479/d.cnki.gzgcd.2021.000101

Wang, X. (2023). Building Smart Classrooms: From the Perspective of Technology Symbiosis (doctoral dissertation). Southwest University. Available at: https://link.cnki.net/doi/10.27684/d.cnki.gxndx.2023.000003

Wu, Y., Wu, H., Chen, Y., Zhou, S., Zhou, Z., Xiao, Y., & Ni, Q. (2024). Developing artificial intelligence for good: The shared responsibility of education and artificial intelligence. *China Educational Technology*, 2024(1):51-58. Available at: https://kns.cnki.net/kcms2/article/abstract?v=-0THPtfOh0XHuMvmZSSIJhiC2NIvuxtY4rGKjJB6Snhen9WY5Tc7xy1Yx8bU3ppafbF9cwKZBJAEyshSgkAh2lRCoJXhFvpP8aJ9ZrYi_r838H3YEoYg9dTRY5yJN67&uniplatform=NZKPT&language=CHS

Xia, L., Yang, Z., Huang, R., Gu, J., & Liu, S. (2023). Digitalization of education and educational reform in the new era. *Journal of Central China Normal University (Humanities and Social Sciences Edition)*, 2023(5):1-22. DOI: https://doi.org/10.19992/j.cnki.1000-2456.2023.05.001

Xiao, C. (2023). Digital Human Rights Research (master's thesis). Central South University of Forestry and Technology. DOI: https://doi.org/10.27662/d.cnki.gznlc.2023.000313

Xu, X. (2023). The ethical dilemma of the application of artificial intelligence in education and coping measures. *Software Guide*, 22(9):243-247. Available at: https://www.zhangqiaokeyan.com/academic-journal-cn_software-guide_thesis/02012101912963.html

Yan, J. (2021). The Implementation Mechanism of Whole-Person Education in Secondary Schools (doctoral dissertation). Northeastern Normal University. DOI: https://doi.org/10.27011/d.cnki.gdbsu.2021.000050

Yang, X., Zhang, H., Guo, L., Lin, X., & Li, X. (2018). Developmental challenges and

breakthrough paths of artificial intelligence in education. Modern Distance Education Research, 2018(3):32-40. Available at: https://kns.cnki.net/kcms2/article/abstract?v=-0THPtfOh3TBr4yjHfvIXRFztU5aJtBRzhuOabp4LcFG-FXckdEgPbBWlvZPoDb0gzMpwBa4jhiJNRU9TgoBEL23S6_ZmCZqA6Qv2Z30NAy3KJ20wO2HrkuQ2UeVaUBaOXELNY=&uniplatform=NZKPT&language=CHS

Yu, S. (2020). The future role of intelligent teachers. Beijing Education (General Education Edition), 2020(02):11-12. Available at: https://kns.cnki.net/kcms2/article/abstract?v=-0THPtfOh337INkpVZdI6-iCl9TFfb5sodTQJj2CVMu0cWsqnoJJCUqhnwVc-3Zg4C1TLUZjJkVRTGPay5e9kr1pcT0gyv7bC7sCutoGK_ZxoKUR1d8q9_yNqlDDyZIlH8DS2eH-A=&uniplatform=NZKPT&language=CHS

Zhang, H. & Fu, D. (2001). Information literacy and information technology education. *China Educational Technology*, 2001(9):3. DOI: https://doi.org/10.3969/j.issn.1006-9860.2001.09.002

Zhang, K. (2023). Ethical Issues Associated with the Application of Artificial Intelligence in Education (Master's thesis). Yunnan Normal University. Available at: https://link.cnki.net/doi/10.27459/d.cnki.gynfc.2023.000655

Zhang, Y. (2020). Ethical Reflection on the Impact of Artificial Intelligence on Human Intelligence (doctoral dissertation). Dalian University of Technology. Available at: https://link.cnki.net/doi/10.26991/d.cnki.gdllu.2020.004176

Zhou, G. (2007). The liberation of mankind: The possibility of avoiding being instrumentalized by technology. *Social Science Journal*, 2007(6):44-49. Available at: https://kns.cnki.net/kcms2/article/abstract?v=-0THPtfOh3TaU4jsqIS4alUqvbgyhzVZSHBuUAc7exfc2Em4WBAJlPFlFlzwLVf3hYRct_Y1vLgkvf2ii4uqGqgbPzovjwU-3UBgJo1BYOLNiSfZL8ukh1qA6UkA&uniplatform=NZKPT&language=CHS

Zhu, H., Jing, J., Peng, J., & Sun, Y. (2023). Domestic and international policies and standards for artificial intelligence governance. *China Information Security*, 2023(5):48-52. Available at: https://kns.cnki.net/kcms2/article/abstract?v=oslmGXurZ-pxwg-HQDm_qdBsbCguv3r0LdRg-Xa0eNnARsm73VuYYJ4sxDdfAXeD5pGLWOu9XsTZF3TRDhxt3PkWH08kYblwyN69Jy5cEZetxfmFJ091ESrbUCvXDWUxBXQc7UH-v10=&uniplatform=NZKPT&language=CHS

Zhu, L. & Hu, X. (2022). Implications of UNESCO's Recommendation on Ethical Issues in Artificial Intelligence and China's contributions: From the perspective of human rights protection. *Chinese Journal of Human Rights*, 2022(4):47-64. Available at: https://kns.cnki.net/kcms2/article/abstract?v=oslmGXurZ-QmSjEzE15nwCtCWa8A5uEYWSInAsTvg6LBshvJ1hH6VTh2NEFalUfb94u-aJplzzUAlvjJeSWmv-77RWmwPKfPcE5uGaZIDugaUi63NNc2QkwscZdKeWC8AdTynWlUlc=&uniplatform=NZKPT&language=CHS

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