A normative study of generative artificial intelligence in higher education and implications

Mingyang Ji [1*], Yue Liu [2]

[1,2]*Geely University of China, Sichuan Chengdu, China*

Article Information

Abstract

Generative Artificial Intelligence (AI) has been developing rapidly and its application in higher education is becoming more and more widespread. The action research project of generative AI application by teachers in Tianhe District, Guangzhou City and the application case of Chat Generative Pre-trained Transformer are selected to illustrate that generative AI has brought unprecedented changes to many aspects of education and teaching, academic research, student management and services, and intelligent campus construction. However, along with these extensive applications, a series of ethical risk issues have gradually come to the fore. According to existing research, four major ethical risks of generative AI have been proposed: technology ontology risk, educational data risk, machine algorithm risk, and educational application risk. Combined with the literature "Eco-ethics and Risk Mitigation of Generative Artificial Intelligence Educational Applications", we conduct an in-depth analysis and put forward countermeasure suggestions for the risks faced by generative artificial intelligence in higher education. It helps to promote the healthy and sustainable development of generative AI in higher education and the improvement of education quality.

1. Introduction
Background and significance of the study

With the rapid development of science and technology, Generative Artificial Intelligence (GAI for short) is increasingly widely used in the field of higher education. With its powerful content generation capability, this new AI technology has brought unprecedented changes to education and teaching, academic research, student management and services, and intelligent campus construction. However, along with these extensive applications, a series of ethical risk issues have gradually come to the forefront, so a scientific and reasonable application specification of generative AI is particularly important and deserves in-depth discussion among researchers in the field of higher education.

This study aims to deeply explore the ethical problems caused by generative AI in higher education, analyze the direction of enhancement of the existing countermeasures based on the current ethical problems of

generative AI application in higher education by analyzing the norms of generative AI application, and provide a theoretical basis for the formulation of relevant policies.

With the rapid development of science and technology, Artificial Intelligence (AI) technology is gradually penetrating into various fields of the society, among which Generative Artificial Intelligence (GAI), as an emerging branch of technology, is profoundly changing the way of people's production and life with its powerful content generation ability. In the field of education, especially in higher education, the application of GAI not only brings unprecedented convenience to teaching, but also provides new possibilities for the innovation of education mode and optimization of education resources. However, along with its wide application, how to ensure the reasonable, legal and compliant use of the technology, as well as how to give full play to the potential of GAI technology under the premise of guaranteeing educational quality and educational equity, has become an urgent problem to be solved at present.

research, it provides higher education institutions, educators, policy makers, etc. with scientific decision-making basis and feasible practical guidance to promote the healthy and sustainable development of GAI technology in higher education.

1. Overview of Generative Artificial Intelligence in Higher Education

1.1. Definition and Technical Principles of Generative Artificial Intelligence

Generative AI is a type of AI based on deep learning and big data analytics technology, and its core function lies in the ability to autonomously generate innovative content in various forms, such as text, images, and audio, based on input prompts or contextual information. The technical principles of generative AI are mainly based on advanced algorithms such as Deep Learning, Generative Adversarial Networks (GANs), Variational Auto-Encoders (VAEs), and Transformer models. These algorithms are trained on large amounts of data so that the model can learn the distribution patterns of the data and generate new data samples accordingly.

1.2. State of the Art in Generative AI

The number of papers published with the keyword "Generative Artificial Intelligence" on ZhiNing.com has increased rapidly since 2018, as shown in Figure 1. The search process is: select the keyword "generative artificial intelligence". Analyze the selected literature to conclude that generative AI technology has made significant progress in a number of fields. Text generation, such as the GPT series of models have been able to generate coherent and logical text content; image generation, such as DALL-E, StyleGAN and other models can generate realistic and diverse images.

1.3. Scenarios for generative AI in higher education

Teaching assistance: Generative AI can provide students with personalized learning resources and feedback to help them better understand and master knowledge. Through the intelligent recommendation system, students can obtain learning resources that match their learning style and progress; meanwhile, the intelligent tutoring system can also provide targeted tutoring and advice based on students' learning situation. As one of the pilot districts of the Ministry of Education's Artificial Intelligence (AI) Facilitated Teachers' Workforce Building in Guangzhou, Tianhe District of Guangzhou City, China, has bravely taken the lead in a one-year action research project on the application of generative AI (hereinafter referred to as "Phase I") since July 2023, which has now been completed and has begun. Phase I of the project has now ended and Phase II has begun. In the first phase of the project, a team of 100 pioneering teachers was formed through voluntary application by teachers and recommendation by units. The 100 teachers were organized into more than 20 learning communities, and led by Prof. Li Songlin's Big Concept Teaching from Sichuan Normal University and Prof. Lai Jiahou's training on Big Models from Shanghai Normal University, and tasked to record 6 lectures, 1 public lecture and 1 paper, and to focus on Big Concepts and Big Models under the guidance of Prof. Jiao Jianli and more than 20 other teachers from South China Normal University. With the full support of more than 20 accompanying experts, including Prof. Jiao Jianli, local teacher researchers and the Teacher Development Center of Tianhe District, the research was carried out in an innovative way of teaching and research. By June 2024, the first phase of the project has produced more than 700 video lessons, more than 50 master classes, a collection of related papers, a collection of teaching micro- innovations, a

regional teaching digital literacy enhancement online course and other series of results, and condensed new ways of teaching and research such as "anti-chaining of lessons", "decoding of excellent lessons", and so on. New ways of teaching and research have been crystallized, such as "backlinking with lessons" and "decoding excellent lessons", which have strongly promoted the digital transformation of teaching and

Academic research: generative artificial intelligence is also increasingly widely used in academic research. It can help researchers quickly generate text content such as research reports and paper abstracts to improve research efficiency; at the same time, it can also provide researchers with new research perspectives and methods through data analysis and mining. The development and advancement of scientific research in various fields based on AI technology depends largely on the availability of scientific data.Generative AI such as ChatGPT (Chat Generative Pre-trained Transformer) accelerates the intelligent and automated analysis and processing of research data, and reduces the cost of applying open-access AI technology, which can further enhance the open-access research results. It can further enhance the usability and accessibility of open access research results as well as improve the quality of open data. Whether it is open access to scientific and technological literature, open publishing, preprint publication, or open sharing of scientific data and algorithm source code, there are problems such as high open cost and limited open sharing. Generative AI can utilize its powerful natural language processing ability to further improve the quality of open sharing of scientific information resources.3

2. Research Methods
Ethical Risks of Generative Artificial Intelligence in Higher Education
In terms of case selection, this study takes the paper "Research on Ethical Risk Management Framework of Generative Artificial Intelligence Application in Education" on Knowledge.com as the research object, which points out that the ethical risk of AI arises in the relationship between the game of science, technology, and human beings. For educators, the new paradigm of teaching brought about by generative AI tends to make teachers cede their responsibilities to AI, leading to the dissolution of teacher status and alienation of teacher-student emotions. Scholars are often concerned about the risk of academic plagiarism that arises when humans co-create with technology. And four major ethical risks of generative AI in higher education are proposed (see Figure 2), namely, technology ontology risk, educational data risk, machine algorithm risk and educational application risk. By analyzing and combing the existing studies, the following is a summary of the four major risks.

2.1. Technology ontology risk
The risk of technological ontology in the field of education refers to the fact that artificial intelligence has become a fundamental element of educational activities, leading to the dislocation of human and technological subjects; the subject of education is governed by new pedagogical principles, and technology replaces the status of the subject of technological innovation. This induces the risk of technological fetishism and technological dependence, with the former manifesting itself in excessive trust and dependence on artificial intelligence, and the latter in the form of an individual's addiction to technology and neglect of the purpose and meaning of education.

2.2. Education data risks
Educational data risks include three main categories: data leakage risk (leakage of sensitive data due to lack of protection mechanisms and awareness), data distortion risk (loss of timeliness and accuracy due to unidirectionality of the collection channel and failure to update and maintainthe data in a timely manner), and data misuse risk (unauthorized collection, use beyond the scope, and inappropriate modification of the data to achieve non-educational purposes). Balancing educational privacy and data sharing is an ethical challenge for the development of generative AI.

2.3. Machine algorithm risk
Machine algorithm risks include: algorithmic discrimination and bias risk (inheriting and reinforcing discrimination and bias in the original data), algorithmic homogeneous recommendation risk (recommending homogeneous and low-quality content for users such as children, forming an information cocoon),

algorithmic curing risk (algorithmic functionality deficiencies that lead to results that deviate from the actual needs or errors), and algorithmic opacity risk (algorithmic algorithmic logic is opaque, forming an elusive black-box social form).

2.4. Education application risk

Risks of educational applications include: the risk of reconstructing teacher-student relationships (capturing data through devices leads to excessive supervision and evaluation, dissolving the status of teachers and alienating their emotions), the risk of loss of autonomy (AI enters campuses in the role of a "caretaker," depriving teachers and students of their autonomy), the risk of damage to educational equity (exacerbating the digital divide, with technologically superior regions and individuals gaining more advantages), and the risk of accountability evasion (lack of technological accountability mechanisms and feedback channels, treating teachers and students as data-trained "tool people," limiting thoughts and behavior). Risk of damage to educational equity (exacerbating the digital divide, with technologically superior regions and individuals gaining more advantages), and risk of accountability evasion (lack of technological accountability mechanisms and feedback channels, treating teachers and students as data-trained "instrumental people", restricting their thoughts and behaviors, and challenging the status of the main body of education).

3. Results and Discussion

Strategies for mitigating the ethical risks of generative artificial intelligence educational applications

Examining and analyzing the existing literature on "Ecological Ethics and Risk Mitigation of Generative Artificial Intelligence for Educational Applications," this dissertation proposes the following mitigation strategies to address the ethical risks that may arise from the application of generative artificial intelligence in higher education.

3.1. Designing ethical guidelines based on teachers' different demands in human-computer interaction

3.2. Designing Ethical Guidelines for Intelligent Mining of Affective Data in Response to Teachers' Emotional Appeals in Human-Computer Interaction

Educators and administrators master emotion expression, capture, analysis and communication technology, and flexibly use intelligent technology to optimize students' human-computer interaction experience. Through emotion recognition, emotion calculation and other technologies, the meaningful learning process of students is combined with intelligent mining of emotional data to build a high-quality and humanized human-computer interaction model.

3.3. Designing Ethical Guidelines for Intelligent Assessment for Value-added Evaluation of Students for the Humanistic Aspirations of Human-Computer Interaction

Due to the defects of generative AI in capturing and analyzing information in terms of emotional, moral, and ethical cognition and evaluation, intelligent assessment should not only focus on students' behavioral performance at a certain point in time, but also embed the concept of value-added evaluation, pay attention to the growth process of students' lives, and pay attention to the long-cycle excavation of their logical thinking construction, emotional awareness appeal, and the formation of their moral qualities, so as to dissolve the ethical risks generated by the bias of data decision-making. Ethical Risks.

3.4. Guidelines for the development and application of generative artificial intelligence in education for designing human-computer interaction for parenting claims

Education needs to seek how to carry out the essence of human education, which is to establish moral character, from the game of educational ecology, social ecology and technological ecology. In the design and application of generative artificial intelligence, attention should be paid to the basic laws and trends of the change of educational ecology, and teachers and students should be guided to construct a reasonable ethical view of technology through ethical classes and technical guidance.

3.5. Continuous improvement of "human-technology" relationships and the effectiveness of technology integration

In terms of continuous improvement of the human-technology relationship, the focus should be on improving teachers' smart education literacy and students' cognitive skills in smart technologies. Teachers need to recognize the great value of generative AI in repetitive work and learn to effectively deal with its integration with the educational ecology. Meanwhile, students should be guided to correctly view the intelligent advantages of generative AI, avoid excessive fascination and dependence, and instead choose appropriate technology products for active processing and construction of knowledge.

With regard to the continuous improvement of the effects of the integration of technology and education, there is a need for the top-level design of a generative intelligence educational context with sustainable monitoring capabilities. This includes the timely regulation of the process and manner of generative AI application in education, so as to avoid its dominant educational decision-making and management initiatives that extinguish the creativity of teachers and students, and labeled assessments that confine the free development of students. We should reshape the educational context of generative AI for high-quality education, take care of the changing needs and growth trajectories of students, monitor its application and practice obstruction in real time, comprehensively assess the ethical risks of its educational application, and continuously improve its integration with education.

3.6. Structuring the regulatory mechanism of responsibility

Strengthening data privacy governance and cultivating awareness of responsibility is key to preventing ethical lapses. Stakeholders of educational AI need to improve data privacy protection regulations and not to privately disclose teachers' and students' data without approval. At the same time, the sense of responsibility for protecting data security is embedded in the educational AI service system, forming a responsibility penetration effect and promoting the development of ethical behavior. Although China has enacted the Cybersecurity Law of the People's Republic of China to regulate and safeguard cyberspace and data security, specific legal provisions need to be introduced to address the privacy issues involved in the educational applications of generative AI products. Stakeholders should sign legally binding use contracts to constrain and discipline the behavior of generative AI users and designers, and to prevent third parties from intentionally using data to cause disruption in the operation of intelligent education systems.

Generative Artificial Intelligence Implications for Higher Education

The application of generative artificial intelligence prompts us to re-examine the nature and goals of education. In the context of the information age and the intelligent age, education should pay more attention to cultivating students' innovative thinking and practical ability rather than merely imparting knowledge. Therefore, we need to update the concept of education from knowledge-centered to competence-centered, focusing on cultivating students' independent learning, cooperative learning and innovation ability.

3.7. Innovations in education models

Generative AI offers new possibilities for innovation in education models. For example, intelligent systems can be used to provide students with personalized learning paths and resource recommendations; virtual reality and augmented reality technologies can be used to provide students with an immersive learning experience; and big data and artificial intelligence technologies can be used to provide students with accurate assessment and feedback. These innovative education models will help increase students' interest and motivation in learning, and enhance teaching quality and learning outcomes.

3.8. Optimization of educational resources

The application of generative AI helps optimize the allocation and utilization of educational resources. By intelligently analyzing students' learning data and behavioral patterns, students' learning needs and interests can be accurately predicted, so that learning resources that are more in line with students' needs can be generated or adapted. At the same time, the intelligent system can also intelligently categorize and recommend educational resources to help students quickly find learning resources that suit them. These

measures will help improve the efficiency and effectiveness of the utilization of educational resources and promote the sharing of quality educational resources.

4. Conclusion

This study analyzes the application of generative AI in higher education, the ethical risks it faces, countermeasures, and implications by combing the basic concepts, technological principles, and the current state of development of generative AI. This study still has some limitations. There is a lack of in-depth empirical research and data analysis on specific application cases and effect evaluation of generative AI in higher education. Prospect: to strengthen the exploration of the specific application effects of generative AI in teaching quality improvement and educational resources optimization.

5. References

Li, Q., Liu, H., & Zhang, S. (2024). Development opportunities and promotion strategies of open science under the change of generative artificial intelligence. Library and Intelligence Work, 68(18), 13–22.

Wang, Y.-M., Wang, X.-Y., & Liu, C.-C. (2024). A study on ethical risk management framework for generative artificial intelligence applications in education. Research on Electrochemical Education, 45(10), 28–34+42.

Wang, Z. (2024, November 18). Pioneer analysis of generative artificial intelligence application in basic education teaching—Taking a teacher team building project in Tianhe District of Guangzhou City as an example. Journal of Guangzhou Open University, 1–8. Retrieved from http://kns.cnki.net/kcms/detail/44.1758.Z.20241111.1235.002.html

Zhao, L., & Yan, Z. (2023). Ecological ethics and risk mitigation of generative artificial intelligence educational applications. Journal of Guizhou Normal University (Social Science Edition), (05), 151–160.