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Research on the Opportunities, Challenges, and Countermeasures of Generative Artificial Intelligence for Higher Education

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Abstract: **Generative artificial intelligence has begun to be applied in the field of higher education and has profoundly changed traditional teaching models. Intelligent personalized education is widely implemented, innovative teaching methods, and rich teaching resources have enhanced students' learning experience and improved teaching efficiency. At the same time, generative artificial intelligence has also brought some challenges to the development of higher education, such as concerns about data privacy and security, psychological barriers for teachers and students to apply technology, ethical issues arising from the lack of rules and policy constraints, and constant contradictions and conflicts between data-driven regulation and experience, situational understanding; The many problems caused by excessive reliance on technology. As the cradle of cultivating future elites in society, higher education must actively respond to the challenges represented by generative artificial intelligence, and formulate laws and regulations to ensure digital security; Universities should strengthen education and training for students and teachers on the use of generative artificial intelligence; Establish a sound regulatory and timely intervention mechanism.**

Keywords: Generative artificial intelligence; Higher education; Digital security

As a cutting-edge technology, Generative AI's ability to understand, create, and generate various types of data such as text, images, and music is changing the way various industries operate. Generative artificial intelligence is driving a new technological revolution in the digital age. Generative artificial intelligence, with its interactive mode that is highly close to humans, has enabled "generative AI+education" to flourish globally and promote the modernization of education. Contemporary higher education should seize the opportunities of technological development in the era, face challenges directly, build a human-machine integration model, and promote high-quality development of higher education.

I.OPPORTUNITIES BROUGHT BY GENERATIVE ARTIFICIAL INTELLIGENCE TO HIGHER EDUCATION

The innovative value of generative artificial intelligence in educational scenarios may be greater than we can realize. Its enormous application value and development potential can provide suitable learning content and methods for every student, greatly impacting traditional teaching models. The "generative AI+education" deeply changes the thinking mode, internal structure, and even the education system itself of higher education, providing practical opportunities for creating a learning society where "everyone can learn, everywhere can learn, and always can learn".

Generative artificial intelligence can greatly meet the personalized education needs of students. Teachers can use advanced artificial intelligence technology to obtain learning data for each student, including their learning progress, understanding level, and potential difficulties. Through this data, generative artificial intelligence can conduct in-depth analysis on each student, accurately understanding their learning habits, abilities, and interests, thereby identifying their knowledge blind spots and potential abilities, and helping teachers customize personalized chemistry learning plans for each student, not only meeting their personal

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development needs but also highlighting their characteristics. The application of generative artificial intelligence has begun to change traditional educational models, opening a new door for the future development of higher education. In addition, generative artificial intelligence can dynamically push learning content based on students' learning situations, and provide real-time feedback and guidance. Generative artificial intelligence can analyze students' learning progress and knowledge needs based on their learning data, recommend the most suitable learning materials in real-time, greatly reducing students' time and energy in searching for materials, allowing them to focus more on learning itself. For example, if a student is particularly interested in a certain topic, the system will also recommend more personalized learning resources to stimulate their learning interest and motivation. This feedback based learning model ensures that students are always in the best learning state. This intelligent learning model can perceive the learning environment, identify student characteristics, and accurately locate students' dynamic learning needs, breaking the mold of traditional education models and providing possibilities for stimulating students' creativity and interest. [1]From the current application of generative artificial intelligence in the field of education, generative artificial intelligence can basically adjust teaching content and difficulty according to students' learning needs, We have initially created a more personalized, flexible, and efficient education model.

Improve and innovate teaching methods. Generative artificial intelligence, as an intelligent teaching assistant, has brought revolutionary changes to modern education.[2] Intelligent teaching assistants are generative artificial intelligence that can liberate teachers from trivial and inefficient affairs, accelerating the transformation from a teacher centered "teaching" to a student-centered "learning" teaching paradigm. In traditional teaching, teachers need to spend a lot of time managing and organizing students' homework and tests, and generative artificial intelligence can automate this process, automatically assigning and correcting homework to students, and providing feedback to teachers. Teachers can adjust the difficulty and content of homework based on students' answers and learning history to ensure that each student can learn at an appropriate level. Convenient Q&A after class. Generative artificial intelligence can provide students with Q&A services at any time, ensuring continuous support during the learning process whether it is weekends, evenings, or holidays. It is a 24-hour online Q&A service, effectively solving the problem of time constraints in traditional teaching.

The interactive teaching of generative artificial intelligence is an important advantage in its application in higher education. Higher education aims to cultivate students' deep learning ability and critical thinking. Generative artificial intelligence can interact with students in both directions by simulating human communication. By asking questions, guiding discussions, and other methods, students can engage in in-depth dialogue, raise questions about complex problems, guide students to analyze and evaluate different viewpoints and arguments, and obtain instant and in-depth answers from AI. This real-time two-way interaction not only enhances students' participation and interest, Moreover, it helps to cultivate students' critical thinking and problem-solving abilities, further improving the effectiveness and satisfaction of learning. The most widely used interactive application of generative AI nowadays is to provide students with simulated learning and practical environments, allowing them to apply their knowledge in real scenarios. Some advanced generative AI can also simulate real human conversations, providing students with a more natural and authentic learning experience. For example, in the process of learning a language, AI can simulate different language scenarios such as shopping, tourism, work, etc., allowing students to practice language use in a virtual environment; We also guide students to role-play, simulate real-life language communication situations, and practice language expression and coping skills through interaction with AI to improve their practical language application abilities. In the process of history teaching, historical scenes can be created to achieve situational teaching, allowing students to return to the historical scene, have a "3D" feeling of being there, enhance the simulation of learning situations, achieve immersive learning, and enhance students' enthusiasm and engagement in learning.[3] Teachers can provide students with more in-depth discussions and guidance based on feedback from simulated environments. When analyzing problems, students can base themselves on a certain historical height, divergent thinking, and better understand and master knowledge.

Generative artificial intelligence can automatically generate rich teaching resources. Generative artificial intelligence can

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automatically generate textbooks, teaching guides, and auxiliary materials based on the curriculum outline or learning objectives by analyzing students' learning data, creating new teaching resources and providing educators with more teaching materials to meet students' learning needs. For example, generative artificial intelligence will automatically search for relevant knowledge points and teaching content based on key information provided by teachers, such as subject areas, knowledge levels, and teaching objectives, and organize them into textbooks. If it is necessary to create a textbook on linear algebra, generative artificial intelligence can automatically generate relevant theoretical parts, including definitions, formulas, properties, etc. If students encounter difficulties in a certain concept, generative artificial intelligence can automatically add more explanations and examples in the textbook, such as videos, animations, games, etc., allowing students to choose the most suitable learning method for themselves. This innovative method can not only greatly save teachers and educators' time and energy, but also be highly targeted. Generative AI can create practice questions and exams tailored to specific knowledge points or skills, and dynamically adjust the difficulty of exercises to provide students with a more effective learning experience. For example, students demonstrate excellent understanding ability at a certain knowledge point, and AI can provide higher difficulty exercises to challenge them; When students encounter difficulties at a certain knowledge point, AI can provide more basic exercises to help them consolidate their foundation. In short, generative artificial intelligence can automatically generate rich teaching resources based on the requirements of teachers and students, which can effectively help teachers better organize and implement teaching activities, and improve teaching effectiveness.

II.THE CHALLENGES BROUGHT BY GENERATIVE ARTIFICIAL INTELLIGENCE TO THE DEVELOPMENT OF HIGHER EDUCATION

Since the birth of humanity, there has always been a complex and subtle connection between technological change and educational innovation. It is undeniable that the development of generative artificial intelligence in the field of higher education has led to educational innovation and change, but it has also brought unexpected challenges to the development of higher education.

The data privacy and security concerns brought about by generative artificial intelligence. The working principle of generative artificial intelligence is to analyze a large amount of student learning data, learn the rules in these data, and then generate new content or predictions based on these rules. In order to predict the learning difficulties of a student in a certain course or generate personalized learning plans for that student, generative artificial intelligence needs to collect a large amount of student data, including basic information, learning experience, test scores, online learning behavior, etc., and then process the data to generate training and application models. So this may lead to data leakage and abuse, which not only brings trouble and trouble to teachers and students, but also may affect more people and fields.[4] Even if the data is not leaked, if it is used for unauthorized or inappropriate non educational commercial purposes, it may raise privacy and security issues. If generative AI collects or uses inaccurate and biased data, the content or predictions it generates may mislead students and have a negative impact on their learning. Therefore, generative AI carries certain risks in the process of collecting and analyzing a large amount of student data, which may lead to privacy and data security issues. Therefore, some scholars have proposed that it is necessary to develop a Chat-GPT system specifically for education to meet the strict requirements of education and teaching.[5]

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The acceptance of technology by teachers and students needs to be improved. As an innovative technology, generative artificial intelligence requires some university teachers and students to overcome psychological and practical barriers to adapt to this technology. Firstly, there are cognitive barriers. Many teachers and students lack a basic understanding of generative AI, not knowing what it is, how it works, and how it is applied in teaching. Coupled with some media hype and misleading, teachers and students may have unrealistic expectations or concerns about generative AI. There are also obstacles in the use of technology. Although many generative AI tools are well designed, some teachers and students may still find it difficult to master, and for those unfamiliar with the technology, they may find the operating interface of generative AI to be complex and difficult to apply. Again, attitudes and cultural barriers. People often get used to old ways with conservative inertia, and may feel uneasy or resistant to the introduction of new technologies, leading to transformative resistance within users. Some teachers and students may question the reliability and effectiveness of generative AI, especially when they are concerned that it may replace human roles or lead to a decrease in the quality of education, resulting in anxiety or lack of confidence in using AI tools. So, for some teachers and students, accepting and adapting to new technologies may require a certain amount of time and effort.

Generative AI lacks rules and policy constraints in the application of higher education. At present, there is a lack of clear rules and policies in many places to guide the application of AI in higher education and protect the rights and interests of students. Once problems arise during the use of AI, such as data leakage or misleading students, it may not be clear who should take responsibility. In addition, when generative AI is used to create textbooks, exercises, and teaching content, it becomes particularly important to ensure the professionalism, accuracy, completeness, and authority of these resources. At the same time, it is also necessary to consider whether these materials comply with educational standards and values, or how to ensure that educational standards and values are the principles followed in model generation. How to avoid bias in generative AI training data is also an issue. For example, AI may overestimate or underestimate the abilities of certain student groups, and the unfairness of the evaluation may result in students not receiving the appropriate academic evaluation, which may affect the evaluation of scholarships or recommendation of internship opportunities, and thus affect students' career planning. So, without the guidance of relevant policies, this bias may be unintentionally amplified, leading to unfair treatment of certain student groups.

Adjusting the contradictions and conflicts between data-driven and experiential, situational understanding. Human experience is rich and colorful, involving various sensory experiences such as emotions, touch, taste, sound, etc. When facing complex problems, humans often rely on intuition, experience, and understanding of specific situations to make decisions. This decision-making process is closely related to biological evolution, cultural background, and the experience accumulated by individuals in their lives. Although generative AI far surpasses humans in processing and analyzing data, its "experience" is not equivalent to human life experience. In other words, when AI processes data, it is identifying patterns and trends, rather than linking information to past personal experiences like humans do. However, the situations in the real world are variable, and it is impossible for all situations to be captured and included in the data. Therefore, human decision-makers often make reasonable judgments about new or unknown situations, and AI may be limited in this regard, resulting in contradictions and conflicts between regulatory data-driven and experiential, situational understanding.

The risk of excessive reliance on technology. Autonomous research, analysis, and critical thinking are the core competencies of higher education. If schools and teachers overly rely on generative AI, they may overlook traditional educational methods and interactions between people, stifle students' ability to think independently, and thus make education lose its true value. In the context of AI, students may only ask questions to AI for convenience, rather than understanding the knowledge points, which can lead to superficial learning. Students only focus on the results without paying attention to the process, lack depth of learning, and are unable to cultivate critical thinking and logical analysis abilities. When answers are readily available, students may lose the motivation to explore and find answers, "leading to the drawbacks of shallow learning, let alone the critical thinking and learning transfer abilities needed to truly learn knowledge." [6]At the same time, AI systems focus on technology and data analysis, while neglecting humanistic care, ethics, and multicultural teaching in education. AI usually makes decisions and recommendations based on big data. If these data come from a single culture or background, it may lead to AI's output biased towards a certain

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culture, while ignoring the existence and value of other cultures. The limited information, learning content, and resources that lean towards a certain culture reduce students' opportunities to interact and understand other cultures, leading to a loss of care and respect for multiculturalism, different backgrounds, and perspectives. But when AI is deeply involved in the education process, it may also lead to a decrease in real communication between people, students' indifference to interpersonal relationships, and a decrease in their communication and teamwork skills.

Bringing academic misconduct. Generative artificial intelligence has the ability to generate academic papers. Although its original intention was to help researchers improve writing efficiency, some students may abuse these tools and directly submit papers generated by AI without conducting any substantive research, thereby reducing the authenticity and quality of academic research. Academic integrity will face a significant impact. During the research process, dishonest researchers may use AI technology to generate fake data or modify or create experimental data to make it appear like real experimental results. Some scholars have even found that some of the references provided by ChatGPT are false references, making it difficult to find the actual source.[7] After being written, generative artificial intelligence may also bypass plagiarism detection systems or modify certain parts of the text to appear original. Because tools for detecting the use of ChatGPT in papers have not yet appeared, "currently, domestic and foreign plagiarism detection and anti plagiarism software systems such as CNKI, VIP, Turnitin, and Grammarly cannot detect text content generated by ChatGPT."[8] It can be seen that the adverse behavior caused by generative artificial intelligence that damages the academic research environment has been paid attention to.

III. STRATEGIES FOR UNIVERSITIES TO COPE WITH GENERATIVE ARTIFICIAL INTELLIGENCE

Generative artificial intelligence has brought many conveniences and possibilities to universities, and is gradually becoming a key driving force in the field of higher education. However, the opportunities and challenges that generative artificial intelligence brings to the field of higher education are also closely intertwined. Higher education institutions must ensure the healthy, efficient, and safe use of AI technology in universities, so that generative artificial intelligence resonates with the development of higher education and complements each other.Develop laws and regulations to ensure digital security. Data is the foundation of generative artificial intelligence systems and is known as the "oil of the new era". When universities use generative artificial intelligence systems for teaching and management, a large amount of personal data of students and faculty will be generated. Legislation should be passed to clarify the ownership and privacy rights of generative artificial intelligence data, and to specify the boundaries for data collection, storage, processing, and use. For the collected and stored data, universities need to adopt strong encryption and security measures to ensure the security of the data. At present, many countries around the world have formulated and promulgated laws and regulations to protect information security, such as the EU's Data Protection Directive, Privacy Protection and Electronic Communications Directive, and China's Personal Information Protection Law. However, these laws and regulations need to be continuously improved with the development of technology. [9]Develop policies and measures to effectively protect and legally promote the interoperability between digital technology and education systems. In addition to basic identity information, students' learning behavior, test scores, online interactions, and other information should be appropriately protected to avoid abuse, thus ensuring that educational innovation based on artificial intelligence technology can continue to develop healthily. For those who access and process this data, strict management and regulations need to be established to regulate the application scope of AI technology, ensuring that they understand and comply with data privacy and security regulations. In teaching, it is necessary to establish rules that clarify that artificial intelligence only collects data directly related to teaching and academic research, and strictly restrict access to students' personal privacy, such as family background, health status, religious beliefs, and other personal information, which should be excluded. When collecting classroom teaching data, it should be limited to collecting students' learning progress, online test scores, interactive records, etc. Even for teaching related data, information related to personal identity should be removed during collection and processing to ensure the anonymity of students. In academic research, it should be emphasized that artificial intelligence is an auxiliary tool, and it is clear that the use of AI is to quickly search, organize, and analyze information in a large amount of academic materials, providing valuable materials and ideas for researchers. At the same time, clarify the role of generative artificial intelligence in student career planning, emphasizing the use

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of AI to analyze students' learning situation and market demand, provide career planning advice and employment opportunities.

Universities should strengthen education and training for students and teachers on the use of generative artificial intelligence. In the era of digitization and intelligence, artificial intelligence is a key technology that affects the development of education. As a "holy land" for education and research, universities have a responsibility to provide training for students and teachers, and scientifically apply artificial intelligence. On the one hand, providing professional training for teachers. [10]As the main body of preaching and teaching, teachers are the key to the scientific use of AI technology in teaching. Scholars have proposed that "it is necessary to enhance teachers' digital literacy, help them master intelligent technology, adapt to new educational scenarios, innovate teaching models and methods... help them shift from knowledge imparters to learning guides and growth coaches." Strengthening teachers' training on the use of AI can deepen teaching reform, innovate teaching models, and truly achieve the breadth and depth of the integration of artificial intelligence and education, Ultimately, it achieves the "empowerment" of artificial intelligence in classroom teaching. Therefore, the training for teachers to use AI should be comprehensive and should be combined with educational background and practical application scenarios. The training content should include basic knowledge such as the definition, principles, history and development of AI; Introduce the application of AI in the field of education, such as intelligent assistants, adaptive learning systems, etc; Infiltrate case teaching analysis, explain cases of using AI technology to improve teaching, assist teachers in student evaluation, classroom management, etc. After conducting basic knowledge learning, universities should organize regular AI technology training and seminars for teachers, so that they can have a deep understanding of the latest trends and trends in AI, correct their understanding of artificial intelligence, and deeply realize that AI is not a tool to replace educators, but a teaching aid tool. On the other hand, educating students about the privacy risks that online platforms and tools may involve. Firstly, we need to explore the online risks of artificial intelligence with students. Introduce common risks such as data leakage, identity theft, and network fraud, such as data disclosure and leakage caused by hacking techniques that break through database security protection or misoperation. Prevent phishing, malware, and other scams that deceive users into providing sensitive information or stealing user information; Remind students not to casually click on links from unknown sources, use strong passwords, regularly change passwords, regularly backup data, install and update security software, etc. Explain common data collection methods such as cookies, IP tracking, and third-party data sharing. Show real cases of data leakage or privacy infringement, allowing students to have a practical perception of the problem. Secondly, divide students into small groups and have each group choose a website or application for research. Provide students with basic theoretical education on privacy protection by sharing key clauses in their analyzed privacy policies, such as data collection, data use, and data sharing, to understand the importance of privacy policies. Once again, encourage students to examine privacy policies from multiple perspectives, such as users, website operators, and third-party advertisers, allowing them to critically consider the pros and cons of these privacy policies and consider their impact on personal privacy. Through these methods, students can not only gain a deeper understanding of the meaning and importance of privacy policies, but also cultivate their critical thinking skills and digital literacy.

Establish a sound regulatory and timely intervention mechanism. From the current level of maturity in the development of artificial intelligence, there is still a way to go to turn AI into ethical AI through moral coding. In order to prevent moral and ethical risks in AI, countries and universities must rely on supervisory and regulatory systems to constrain the AI industry. From an international perspective, some countries have established AI moral and ethical committees at various levels at the national level to assess and review AI moral and ethical risks. In May 2018, the United States established a specialized committee on artificial intelligence to review federal agency investments and developments in the field of artificial intelligence; In April 2019, France established the Artificial Intelligence Ethics Committee to oversee the development of military artificial intelligence; In July, China established the National Science and Technology Ethics Committee with the aim of institutionalizing governance of a series of scientific and technological ethics issues, including artificial intelligence. Some companies, such as Google, Microsoft, and other large technology companies, have also established artificial intelligence ethics committees or leadership groups to supervise AI governance matters and improve decision-making mechanisms.

For universities, an AI ethics committee should be established consisting of members from multiple disciplines including

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technology, education, ethics, law, and student representatives. Firstly, it should be determined that the ethics committee is responsible for evaluating and reviewing the application of AI in universities, ensuring that it adheres to ethical and ethical principles; Provide strategy recommendations for AI usage; Provide AI ethics training and educational resources to relevant departments of the school; The purpose and goal is to supervise and evaluate the actual effectiveness and impact of AI applications. To ensure a comprehensive perspective, the committee should include experts in the following fields and clarify the functions of experts in each field. Experts in technology and engineering, composed of faculty and staff in computer science, data science, or related fields at the school, provide in-depth understanding of AI technology, explain AI decision-making processes, and evaluate technical risks. Experts in the field of philosophy and ethics, composed of faculty and staff in philosophy, sociology, or related fields, specialize in researching ethical and ethical issues, and can provide theoretical support to committees to ensure that the application of AI is consistent with ethical principles. Legal experts, led by professors or legal advisors from law schools, ensure that the use of AI complies with national and international laws, and provide legal advice and guidance. Experts in sociology and psychology study how AI affects society and individuals, providing macro and micro perspectives for committees. Experts in practical application fields, such as medicine, finance, or education, provide practical suggestions based on the specific field of AI application. The Ethics Committee conducts an ethical review of AI usage strategies at least once a year to ensure that the algorithms used in the AI system are fair, the data sources are diverse, and there is no bias towards any specific group.

As students who serve and benefit from artificial intelligence, they also have to fulfill their supervisory obligations towards artificial intelligence. Student representatives composed of student unions or other student organizations provide students' perspectives and feedback to ensure that their rights and interests are protected. Student supervision is mainly achieved through feedback to schools, news media, industry associations, and the government. For students with ethical consciousness in artificial intelligence, they can perceive the breakthrough behavior of artificial intelligence in ethics through their interaction with artificial intelligence, thereby self-regulation and mastering the initiative in an intelligent society. For example, addressing algorithm bias and discrimination issues in artificial intelligence. A series of algorithmic discrimination research reports released by the United States have exposed the problems in the development of artificial intelligence to the public, effectively promoting public awareness of related issues. [11]Once students believe that there are anti ethical factors in the responsible party of artificial intelligence products, there must be a specialized school institution to receive and handle students' feedback. Therefore, schools need to establish and improve channels for providing relevant supervision to students.

IV. CONLUSION

In higher education, "generative AI+education" is a double-edged sword that greatly improves the quality and efficiency of teaching in universities, enriches teaching resources, and personalized education methods also stimulate students' interest and enthusiasm for learning, profoundly changing traditional teaching models. However, it may also bring privacy and ethical risks, as well as many academic misconduct issues. As the cradle of cultivating future elites in society, higher education must actively respond to the challenges represented by generative artificial intelligence, and formulate laws and regulations to ensure digital security; Universities should strengthen education and training for students and teachers on the use of generative artificial intelligence; Establish a sound regulatory and timely intervention mechanism. To ensure the healthy development of 'generative AI+education'. The generative pre training converter based on generative artificial intelligence is still continuously improving its performance, thereby demonstrating new capabilities. Constraints such as concepts, economy, and security have been demonstrated in the application of ChatGPT in higher education. It reflects the intelligence of generative AI and also has the "common faults" of artificial intelligence, namely the alienation of learner subjectivity, difficulty in distinguishing the reliability of generated content, and infringement of information security Addressing hidden concerns such as academic integrity challenges requires educators, relevant technology developers, technology research and development companies, and governments to jointly pay attention to the impact of generative artificial intelligence on higher education and explore solutions.

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