

The Impact and Prospects of AI-Generated Content in Educational Environments

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Abstract. This paper examines the impact and emerging prospects of generative artificial intelligence (AI) content creation (AIGC) within the educational sector. As AI technology continues to evolve rapidly, the potential for AIGC to revolutionize educational practices has garnered significant interest and scholarly focus. AIGC is proving instrumental in developing customized educational content, facilitating personalized learning experiences, and enhancing assessment methods. These capabilities have the potential to significantly boost teaching efficiency and elevate student outcomes. Nonetheless, the integration of AIGC also poses several challenges, including concerns over academic integrity, shifts in the instructional roles of educators, and issues related to data privacy and ethical considerations. This analysis delves into the current applications of AIGC in education, discussing technological trends, innovations in educational models, and strategic policy recommendations. It underscores the necessity for future research to concentrate on evaluating the practical effects of AIGC, addressing potential drawbacks, and ensuring its responsible growth in educational settings.

Keywords: Generative AI; Personalized Learning; Academic Integrity; Data Privacy.

1. Introduction

With the rapid advancement of artificial intelligence technology, generative artificial intelligence has emerged at the vanguard of today's technological revolution. Its application potential in education is being extensively explored by researchers and practitioners globally [1]. Before AIGC fundamentally reshapes education, the speculative implications for this sector fuel widespread curiosity and active research. This burgeoning interest underscores the importance of maintaining an open yet cautious approach to research. Education, a critical domain for knowledge dissemination and skill development, has consistently been transformed by technological innovations—from blackboards to digital projectors to intelligent tutoring systems. Each technological leap has significantly enhanced pedagogical methods and learning experiences. Currently, AIGC is poised to drive profound technological shifts in education. Central to AIGC's value is its robust data processing and content generation capabilities [2]. Employing natural language processing (NLP) and machine learning (ML), AIGC can create new texts, images, and even audio, opening up unprecedented opportunities for developing educational materials, tailoring course content, and enriching interactive learning experiences. For instance, tools like ChatGPT can instantly produce responses and explanations based on student queries, fostering a more adaptive and personalized learning environment. Moreover, the scope of AIGC applications extends beyond mere question-and-answer formats; it encompasses the design of learning trajectories, optimization of pedagogical strategies, and even innovations in educational assessment.

Nevertheless, the integration of AIGC into education is not devoid of controversy. Concerns about its impact on the roles of teachers, alterations in student learning modalities, and potential challenges to academic integrity all represent significant hurdles for educators, scholars, and policymakers [3]. These issues highlight the necessity for a balanced approach to harnessing AIGC's potential while mitigating adverse effects. Consequently, research on AIGC in education demands not only technological investigation but also comprehensive studies and collaborations across disciplines such

as education, ethics, and policy [4], ensuring a responsible integration of this technology into educational frameworks.

2. Educational Thinking Triggered by AIGC

Today, as AIGC technology is rapidly developing and applied in the field of education, it not only brings convenience to educational practice, but also triggers a series of in-depth thinking and discussion [5]. First, the impact of AIGC on educational equity has become a widely concerned issue. Although AIGC can provide personalized learning resources, which theoretically helps to narrow the gap in educational resource inequality, its high technical costs and usage threshold may instead aggravate educational inequality [6]. In addition, while improving learning efficiency, AIGC may cause students to rely too much on machine-generated content and neglect the cultivation of critical thinking and creative thinking.

At the same time, the use of AIGC in education also touches on many aspects of educational ethics. For example, whether the content generated by AIGC can represent students' own thinking to some extent, and whether students' use of AIGC to assist in completing homework and projects should be regarded as a new type of academic dishonesty, the answers to these questions will affect our definition and evaluation criteria of academic integrity [7]. Furthermore, the popularity of AIGC may also affect the professional positioning and role of teachers. Although AIGC can undertake part of the teaching tasks and reduce the workload of teachers, over-reliance on AIGC may also prevent teachers from giving full play to their teaching skills and creativity [8]. Therefore, how to maintain the dominant position of teachers while giving full play to the advantages of AIGC is an issue that the education community needs to think about together.

In summary, the application of AIGC technology in the field of education has triggered extensive educational thinking. It is human nature to embrace opportunities and seek benefits and avoid harm. Some completely restrictive measures can only be stopgap measures. Technological development is always on the road, and revolutionary impacts are always in the process. In the face of major challenges caused by ChatGPT, the education system must correctly handle important relationships such as the changes and invariances of education, the fairness and efficiency of education, and the specificity and versatility of technology [9]. It must properly grasp the direction and limits of the integrated development of artificial intelligence technology and education, so that technology can better benefit mankind and promote the sustainable development of education and society [10]. In the face of these problems, educators, technology developers and policymakers need to work together to explore reasonable application frameworks and specifications to ensure that AIGC technology can contribute to educational development on the basis of respecting educational values and ethical principles.

3. Current Status of AIGC Application in Education

The application of AIGC (artificial intelligence generated content) technology in education covers many aspects such as teaching content generation, personalized learning, educational evaluation and feedback.

3.1. Teaching Content Generation and Creativity

AIGC has demonstrated strong capabilities in the field of teaching content generation. A fifth-grade teacher, Piercey, shared his process of using AIGC to reassemble a student's story into nursery rhymes, serials, and children's books. He explained in detail how AIGC can subtly add elements you want to add to a short story created by a fifth-grade student, such as robots, random characters, etc., to build a richer story. He believes that the emergence of AIGC has added possibilities to interesting classes and provided students with some very unique examples. Students can learn how to make writing more vivid and interesting. AIGC can generate a variety of unexpected educational resources, including images, audio, and video modes. It not only gives teachers the ability to choose a variety of teaching

methods, but also brings more possibilities to education, injecting new vitality into the field of teaching. Teachers can generate courseware that meets the current situation according to the needs of the class and teaching. These courseware are rich in content and ensure quality, which can greatly save teachers' time. The educational resources generated by AIGC truly break the tradition. For example, teachers can create a new interactive laboratory that does not require physical resources and can conduct various experiments online.

AIGC can not only create a realistic story, a wonderful article, and a beautiful poem, but also provide guidance for writing and programming code assignments. In terms of writing, AIGC can encourage students to write more deeply and improve their critical thinking through writing prompts. In addition, AIGC can enable students to recognize different writing genres and styles, and help students overcome their fear of writing in an interesting way. In terms of auxiliary programming, AIGC can automatically generate the required code for students, encouraging students to focus their energy on more creative ideas.

3.2. Personalized Learning

Personalized learning is a highlight of AIGC in the field of education. The disadvantage of the traditional education model is that a single education method may not be suitable for everyone, while AIGC can achieve teaching classification. Excellent students and poor students do not need to use the same set of teaching resources. AIGC can tailor teaching resources for multiple types of students, truly achieving teaching without distinction. Every student has his or her own learning style and plan. AIGC has great potential for application in personalized learning. It can generate automated learning content, adjust teaching content and difficulty in real time, and ensure that every student can learn at his or her own pace. This not only improves learning efficiency, but also enhances students' interest and enthusiasm in learning.

Existing studies have shown that AIGC and similar chatbots are effective in providing personalized learning guidance and can further improve learning outcomes. Its dialogue function can promptly correct students' misunderstandings and provide tailored explanations that are consistent with the knowledge comprehension levels of students of different age groups.

At the same time, AIGC can assist teachers in generating personalized teaching evaluation projects, making teaching evaluation fairer. For example, a study developed an evaluation task related to middle school students' life phenomena through AIGC to evaluate students' learning performance, including titles, directions, and evaluation criteria, and verified the effectiveness of this evaluation project through empirical research.

3.3. Educational Assessment and Feedback

AIGC is also widely used in educational evaluation and feedback. The automated grading system can quickly and accurately evaluate students' homework and exams, reducing the workload of teachers. For example, AIGC can automatically grade essays and test papers according to preset grading standards, and provide detailed grading reports and improvement suggestions. In addition, AIGC can also generate personalized learning feedback to help students understand their learning progress and weak links, so as to make targeted improvements and enhancements. Through detailed data analysis, teachers can obtain detailed data on students' learning process, such as learning time, learning methods, and knowledge point mastery. For example, in an online learning platform, after completing an online test, students can immediately obtain a detailed test report, including accuracy, error analysis, knowledge point mastery, etc.

Specific cases show that AIGC has achieved remarkable results in educational practice. For example, in a computer course at a certain university, AIGC is used to generate programming exercises and experimental instructions, which greatly improves teaching efficiency and students' hands-on ability. In primary and secondary schools, AIGC is used to generate reading comprehension questions and

math question banks to help students consolidate classroom knowledge and improve learning outcomes.

As shown in Figure 1. Through these cases, the great potential of AIGC in improving teaching quality, promoting personalized learning, and improving the efficiency of educational evaluation.

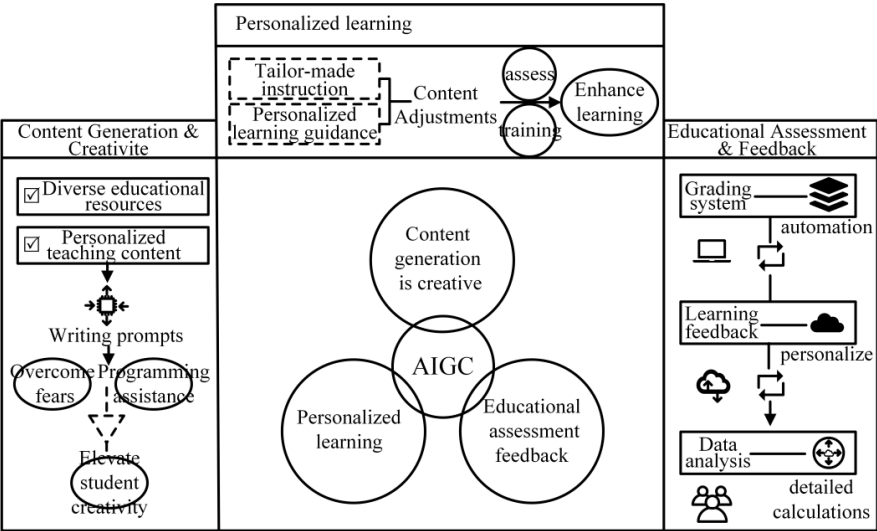


Figure 1. The current status and future development framework of AIGC in education (Photo credit: Original).

4. Potential Risks of AIGC In Education

Although AIGC has shown broad application prospects in education, its potential risks cannot be ignored. These risks mainly focus on academic integrity, changes in the role of teachers, data privacy, and ethical and legal challenges.

4.1. Academic Integrity Issues

The widespread use of AIGC may lead to an increase in academic integrity issues. Since AIGC can generate high-quality texts and answers, students may use it to cheat and plagiarize, which poses a severe challenge to the traditional academic evaluation system. Many teachers also believe that it is difficult to distinguish whether the homework is generated by AI or completed by students through independent thinking. Students can use AIGC to generate complete papers or answer complex homework questions, thereby avoiding the process of independent thinking and learning. This will undoubtedly prevent some students from learning knowledge while causing academic integrity issues.

4.2. Changing Roles of Teachers

The application of AIGC may lead to changes and weakening of the role of teachers. With the widespread application of AIGC in teaching, the traditional role of teachers may be redefined. Teachers are not only the transmitters of knowledge, but also the guides and supporters of students' learning. However, the automation function of AIGC can replace some of the responsibilities of teachers, thus affecting the core position of teachers in education. This is not only a blow to the professional ability of teachers themselves, but also a blow to the traditional role of teachers. How teachers can adapt to the new educational environment and ensure that they continue to play a key role with the assistance of AIGC is still a problem that needs to be solved step by step.

4.3. Data Privacy and Security

First, generative AI may generate a lot of false information, which may seriously mislead students. From the technical essence, the content generated by generative AI is actually a reorganization of various learning materials. It does not judge the rationality of the generated content itself. It is worth

noting that unlike search engines, generative AI such as ChatGPT does not provide the source of information, and also adopts a more direct way in the form of information push, so it may be more misleading, and therefore may cause greater harm. Secondly, the application of AIGC involves a large amount of student data, which brings up data privacy and security issues. AIGC needs to collect and analyze a large amount of personal data to provide personalized learning experience and feedback. However, if these data are not stored and processed properly, it may lead to data leakage and abuse.

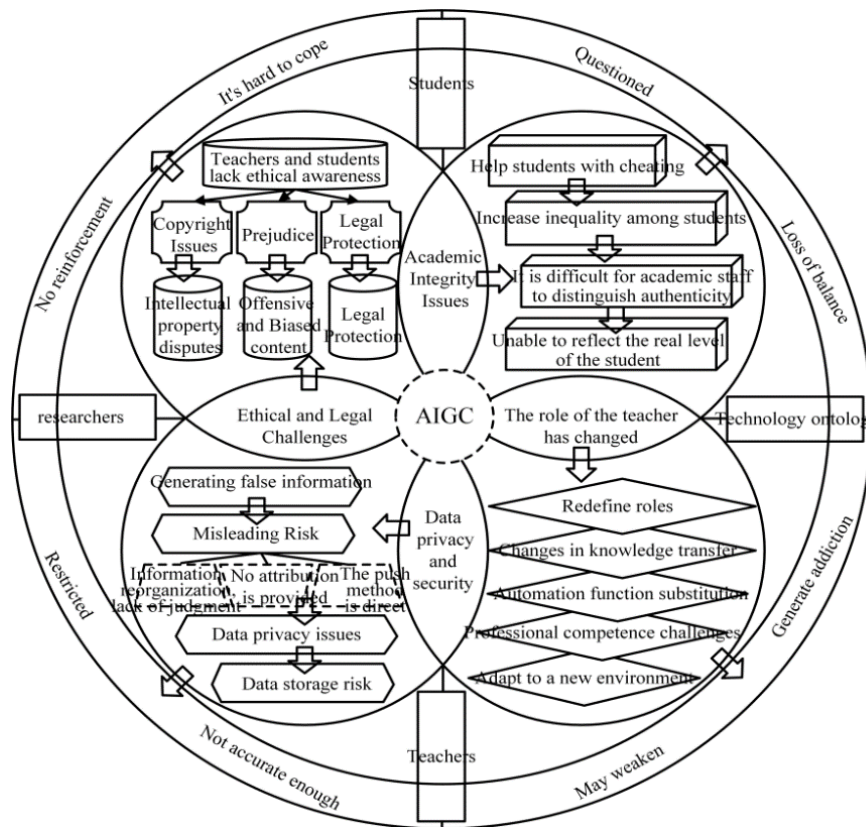


Figure 2. Analysis of the challenges of AIGC in education (Photo credit: Original).

4.4. Ethical and Legal Challenges

The application of AIGC in education still faces many ethical and legal challenges. The first is the issue of copyright. Although generative AI is creative on the surface, in essence, its creation is just a re-combination of its learning materials. For this reason, the famous linguist Chomsky even directly called ChatGPT high-tech plagiarism. In this case, if the research and development institution fails to obtain full authorization from the provider of training materials when training AI, it is likely to cause intellectual property disputes. In fact, some similar cases have already occurred. For example, Dow Jones, a subsidiary of News Corp., one of the world's largest media groups, recently issued a statement accusing OpenAI of using the Wall Street Journal in violation of regulations without Dow Jones' authorization. There are also some views that from a business perspective, if AIGC is not given intellectual property protection at all, it will be unfair to companies that invest huge amounts of money in the research and development of AI. The copyright ownership of the content generated by AIGC is still unclear, which may lead to legal disputes. Secondly, algorithmic bias is also an issue worthy of attention. The training materials of generative AI come from human works, so it is also possible that it will inherit the discriminatory factors contained in human works. If AIGC's training data is biased, the generated content may also reflect these biases, affecting the fairness and impartiality of education. As shown in Figure 2.

5. Future Prospects And Summary of AIGC In Education

The application prospects of AIGC technology in education are broad, and future development will further promote the innovation of education models and the improvement of education quality. Through the analysis of technology trends and policy recommendations, the important role and potential impact of AIGC in education.

5.1. Technology Trends

The development of AIGC technology will continue to promote innovation in the field of education. With the advancement of natural language processing and generation technology, AIGC will be able to generate more complex and high-quality educational content to meet the needs of different disciplines and educational stages. AIGC's multimodal generation technology will also be further developed to generate a variety of educational resources including text, images, audio and video, enriching teaching content and forms. In the future, AIGC will also combine virtual reality and augmented reality technology to provide an immersive learning experience and further improve educational effectiveness.

5.2. Education Model Innovation

AIGC will promote innovation in education models and change traditional teaching and learning methods. Virtual classrooms and intelligent learning environments will become an important part of future education. Through AIGC technology, students can learn interactively in a virtual environment, breaking the limitations of time and space. The intelligent learning environment will be able to adjust teaching content and learning paths in real time based on students' learning data, providing a personalized learning experience. This innovative education model not only improves learning efficiency, but also promotes students' autonomous learning ability and innovation ability.

5.3. Policy Suggestion

To foster the responsible advancement of Artificial Intelligence Generated Content (AIGC) in education, it is crucial for policymakers to develop specific policies and regulations. Regarding intellectual property rights, attention must be directed towards protecting the rights of training material providers and determining the eligibility of generative AI works for intellectual property protection. Prompt establishment of relevant legal norms is essential. Conditions under which AI's utilization of learning materials constitutes fair use versus infringement must be clearly delineated, with a detailed explanation of the rights, responsibilities, and interests of various stakeholders in differing scenarios. Additionally, the potential for intellectual property protection of AI-generated works should be evaluated based on criteria such as innovation and a realistic balance of interests. Issues like misinformation, security, and privacy require initial examination through the lens of existing laws and regulations. Should gaps be identified in these regulations, legislative measures may be necessary. Educational institutions are advised to implement rigorous data management policies to safeguard student data privacy and security. Employing technical solutions such as data encryption and access control can effectively prevent unauthorized data access and use.

5.4. Research Direction

As shown in Figure 3. Future research should focus on the application effects and potential problems of AIGC in education. For example, study the application effects of AIGC in different educational stages and disciplines, and explore its impact on student learning outcomes and teacher teaching quality. Study the ethical and legal issues in the application of AIGC, and propose solutions and policy recommendations. The development trend of AIGC technology and explore the application potential and challenges of new technologies in education. For example, study the combination of virtual reality and augmented reality technology with AIGC, and explore the application prospects and effects of immersive learning.

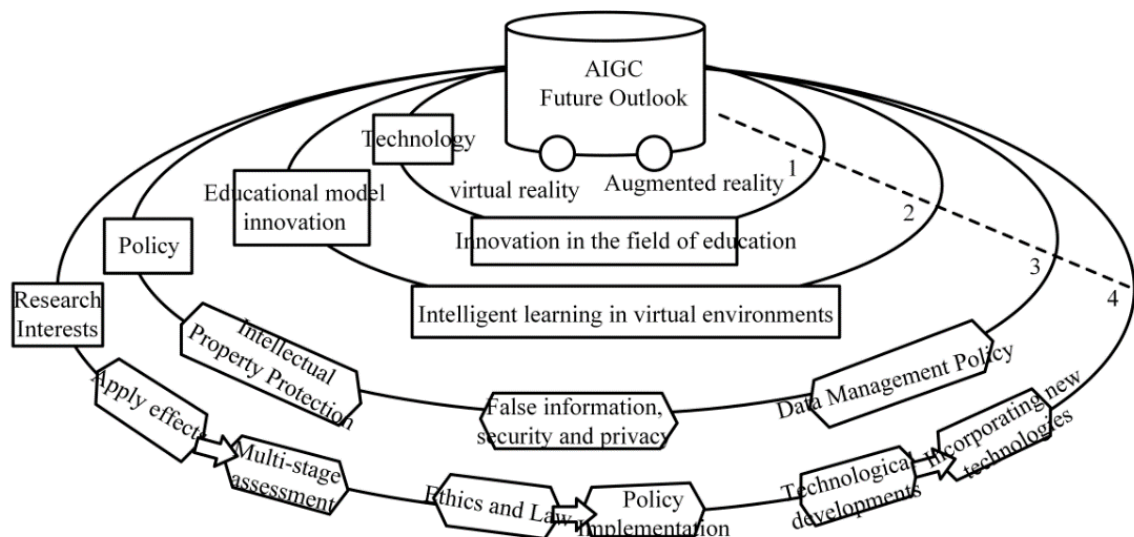


Figure 3. Future Prospects of AIGC (Photo credit: Original).

6. Conclusion

The exploration and integration of Artificial Intelligence Generated Content (AIGC) within educational settings have demonstrated significant potential to revolutionize teaching and learning practices. Specific instances, such as its application in generating programming exercises at universities and crafting question banks in primary and secondary education, have notably enhanced both teaching efficiency and students' learning capabilities. These applications underscore AIGC's profound impact in fostering personalized learning experiences and optimizing educational assessment processes. However, the incorporation of AIGC is not without its challenges and risks. Issues such as academic integrity become prominent as students might leverage AI-generated content for plagiarism, posing significant threats to traditional educational assessments. The role of educators is also shifting, with AI potentially diminishing the centrality of teachers in educational systems, which could impact the pedagogical relationship between students and teachers. Moreover, concerns around data privacy, security, and the ethical use of AI-generated content highlight the need for stringent safeguards and transparent policies to manage and regulate AI applications in education.

In conclusion, while AIGC offers transformative prospects for education, its successful integration depends on a balanced approach that promotes innovation and addresses potential drawbacks through thoughtful regulation and the active involvement of all educational stakeholders. This balanced approach will ensure that AIGC contributes positively to the educational landscape, enhancing learning outcomes while respecting ethical standards and legal requirements.

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