Research on the Construction of Advanced Mathematics Courses under AIGC

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Abstract: The education industry is seeing an unparalleled metamorphosis due to the swift advancement of Artificial Intelligence Generated Content (AIGC) technology. As a prerequisite for many disciplines, advanced mathematics has a direct effect on students' learning results in later specialized courses as well as their development of creative thinking. The purpose of this article is to investigate how AIGC technology can facilitate the development of advanced mathematics courses. It suggests a number of creative course building techniques by examining the features and benefits of AIGC technology in combination with the real requirements of teaching advanced mathematics. Enhancing the efficacy of advanced mathematics education, igniting students' curiosity, and developing well-rounded individuals with creative problem-solving and thinking abilities are the objectives.

***Keywords*:** AIGC; higher mathematics; course construction; intelligent teaching resources

1. Introduction

Advanced mathematics, as one of the core courses in higher education systems, not only bears the responsibility of imparting mathematical knowledge and skills but also shoulders the important mission of cultivating students' logical thinking, abstract thinking, and innovative abilities. However, under traditional teaching models, advanced mathematics courses often face issues such as complex and abstract content, monotonous and outdated teaching methods, and insufficient student initiative in learning. The emergence of AIGC technology[1] has provided new ideas and tools for the construction of advanced mathematics courses. Through intelligent and personalized teaching methods, it is hoped that these technologies can break through the limitations of traditional teaching and significantly improve teaching quality. This article will start from the core concepts of AIGC technology and delve into its application paths in the construction of advanced mathematics courses.

2. AIGC Technical overview

The term AIGC describes the use of AI technology to automatically generate several types of digital content, including text, photos, audio, and video. Advances in cutting-edge technologies such as deep learning, natural language processing, and computer vision are essential to the development of AIGC technology because they allow machines to comprehend and imitate human creative processes, producing innovative, varied, and customized material. With ongoing algorithm model optimization and steady increases in processing power, AIGC technology has shown great promise for use in a variety of industries in recent years, including media, advertising, education, and entertainment. The following benefits of AIGC technology are well known[2]:

(1) Efficiency and automation.

The efficiency and scale of content production are greatly increased by AIGC's ability to process vast volumes of data rapidly and produce rich, varied digital content. Simultaneously, the automated generation process lowers expenses and human intervention.

(2) Creativity and personalization.

In addition to mimicking human creativity, AIGC can use algorithm innovation to produce original and distinctive content. Furthermore, AIGC can achieve tailored content customization to satisfy the requirements and preferences of various users based on user profiles and data analysis.

(3) Interactivity and real-time.

AIGC technology can improve user experience by interacting with users in real time and modifying generated content based on their instructions and feedback.

3. Analysis of the current situation of advanced mathematics course

University freshmen majoring in non-mathematical sciences and engineering (including some humanities and social sciences) are required to take Advanced Mathematics, a crucial foundational course.[3] It not only cultivates students' abilities in mathematical computation, abstract thinking, spatial imagination, and scientific innovation but also lays a solid foundation for their subsequent professional courses. However, the Advanced Mathematics course still faces some challenges.

3.1 Limitations of teaching content and methods

The current content of advanced mathematics courses focuses heavily on the explanation of theoretical knowledge and the teaching of problem-solving techniques, lacking a close integration with practical applications. This makes it difficult for students to apply what they have learned to solve real-world problems. In terms of teaching methods, traditional lecture-based instruction dominates, lacking interactivity and engagement, which fails to stimulate students' interest and initiative in learning.

3.2 Students' learning needs and motivation are insufficient

Advanced mathematics courses possess a high degree of abstraction and logic, placing significant demands on students' learning abilities and cognitive levels. However, due to individual differences, some students struggle to adapt to the course's difficulty, developing a fear of challenges and leading to insufficient motivation. Additionally, the lack of personalized learning resources and guidance makes it difficult for students to tailor appropriate study plans based on their own circumstances.

4. Application strategy of AIGC in the construction of advanced mathematics course

4.1 Build an intelligent teaching resource base

Intelligent Generation of Teaching Resources: Leveraging AIGC technology, it can automatically generate teaching resources required for advanced mathematics courses, such as presentations, exercises, and case studies. By processing and analyzing raw data from textbooks and supplementary materials using algorithmic models, key knowledge points and problem-solving strategies are extracted to create content that meets teaching requirements. At the same time, based on students' learning progress and feedback, the difficulty and format of the generated content can be dynamically adjusted, enabling personalized customization of teaching resources.

Diversified Teaching Resource Integration: AIGC technology can integrate various forms of digital content, including text, images, audio, and video, to form a multimedia teaching resource library. Through intelligent recommendation algorithms, it provides a wide range of learning resources based on students' needs and interests, catering to different levels and types of learning requirements.

4.2 Implement personalized learning path planning

By leveraging AIGC technology, student profiles can be constructed through the collection of learning data, interests, preferences, and learning styles. Analyzing and mining these profiles allows for precise identification of students' learning needs and issues, providing a basis for subsequent personalized learning path planning.

Based on student profiles and teaching objectives, AIGC technology can automatically generate personalized learning paths. It recommends suitable learning resources and activities according to students' learning abilities and progress, arranging reasonable study times and rhythms. At the same time, through dynamic adjustments and optimizations of the learning path, it ensures that students can learn in line with set goals and directions, enhancing learning effectiveness and efficiency.

Through intelligent analysis algorithms, it identifies students' learning issues and difficulties. By providing timely feedback and personalized guidance, it helps students adjust their learning strategies and methods to overcome learning obstacles. Additionally, using the data from learning progress tracking, it offers teachers teaching feedback and improvement suggestions, promoting the enhancement of teaching quality.

4.3 Carry out interactive classroom teaching

Application of Intelligent Auxiliary Teaching Tools: AIGC technology can develop a series of intelligent auxiliary teaching tools, such as smart Q&A systems and virtual teaching assistants. These tools can answer students 'questions in real-time, provide problem-solving ideas and step-by-step analysis, helping students resolve their learning confusions. At the same time, virtual teaching assistants can offer personalized learning suggestions and feedback based on students' learning situations, promoting interaction between teachers and students as well as among students.

Classroom Teaching Effectiveness Evaluation and Feedback: AIGC technology can monitor and analyze the effectiveness of classroom teaching in real time, including student participation, interaction frequency, and learning outcomes. Through

intelligent evaluation algorithms, it quantitatively analyzes and evaluates classroom teaching effectiveness, providing teachers with feedback and suggestions for improvement. At the same time, the evaluation results can be used to develop personalized learning plans and guidance programs for students, promoting the enhancement of their learning outcomes.

4.4 Establish a diversified evaluation system

The development of diverse evaluation dimensions, such as knowledge mastery, learning ability, innovation ability, teamwork ability, and other dimensions, can be facilitated by AIGC technology.Students' learning performance and developmental stage can be thoroughly and impartially assessed by gathering and examining their learning data and accomplishments.

Intelligent Evaluation Algorithm Application: Students' learning outcomes can be automatically scored and assessed by utilizing AIGC technology's intelligent evaluation algorithms. Evaluation models and standards are developed to swiftly and precisely evaluate student performance using machine learning algorithms that learn from and analyze vast amounts of historical data. In order to ensure fairness and accuracy in evaluations, the intelligent evaluation algorithm can also dynamically modify evaluation criteria and weights based on students' learning circumstances and progress levels. Teachers can better understand students' learning situations and pinpoint problems by intuitively displaying and interpreting these results. This allows them to offer focused advice and recommendations for future instruction. Students can simultaneously set learning objectives and plans for improvement by reviewing the results of their own assessments to understand their learning progress and areas for improvement.

5. Conclusions

One crucial area for future development is the thorough integration of AIGC technology with advanced mathematics courses. It methodically tackles the problems of abstract content, tedious teaching techniques, and limited resources in traditional mathematics education by creating intelligent teaching resource libraries, personalized learning path planning, interactive classroom instruction, and varied evaluation systems. Fundamentally, the profound integration of AIGC and advanced mathematics signifies a change in perspective in mathematics education from "experience-driven" to "data intelligence." This integration will transform the model for skill development, the dimensions of value creation in mathematics education, and the way knowledge is transmitted by striking a dynamic balance between the rigor of disciplinary logic and technological creativity. It will also open up new avenues for developing mathematical talents with algorithmic thinking and innovative capabilities in the digital age.

References

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