International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 9 Issue 6, Nov-Dec 2025 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Innovation and Practice of the Intelligent Teaching of Advanced Mathematics in the Context of Digital Intelligence

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ABSTRACT

With the digital intelligence technologies into the education field, the teaching of Advanced Mathematics faces practical problems such as a single teaching, insufficient personalization, and low accuracy in effectiveness evaluation. This paper proposes the construction of an intelligent teaching featuring teacher-student-AI collaboration. Through the construction of a digital intelligent teaching platform, the optimization of teaching content resources, and the design of a collaborative teaching process, triple innovations in the teaching, resource supply, and evaluation system are achieved. Practice has shown that this can effectively stimulate students' learning interest, improve learning outcomes and teachers' teaching efficiency, providing a replicable practical path for the teaching reform of Advanced Mathematics.

KEYWORDS: *Digital intelligence; Teacher-student-AI collaboration; Advanced Mathematics; Intelligent teaching; Teaching reform.*

How to cite this paper: Zhang Xiangjun | Liu Yichen | Liu Wenqing | Tsering Chokyi | Sun Li "Innovation and Practice of the Intelligent Teaching of Advanced Mathematics in the Context of Digital Intelligence" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-9 | Issue-6, December 2025, pp.90-92, URL: www.ijtsrd.com/papers/ijtsrd98765.pdf

IJTSRD98765

1. INTRODUCTION

The rapid development of information technology has propelled education into the digital intelligence transformation period. Big data and artificial intelligence technologies provide core support for the innovation of Advanced Mathematics teaching[1]-[4].

As a core basic course for science, engineering, economics, management, and other majors in colleges and universities, the teaching quality of Advanced Mathematics directly affects students' subsequent professional learning and logical thinking cultivation. However, currently, the teaching of Advanced Mathematics still mainly relies on traditional lectures, with problems such as students' passive learning, difficulty in taking into account individual differences, and lagging feedback on teaching effectiveness, falling short of the requirements for talent cultivation in the new era.

Some colleges and universities have already attempted to integrate digital intelligence technologies into curriculum teaching, but most have remained at the level of simply piling up online resources or applying simple AI tools, without forming a systematic collaborative teaching system. Based on this, this paper builds an intelligent teaching from the perspective of the three-party collaborative logic of teacher-student-AI, exploring effective ways to address the pain points of traditional teaching and providing practical references for improving the teaching quality of Advanced Mathematics.

2. Construction of the Teacher-Student-AI Collaborative Intelligent Teaching

2.1. Core Construction Objectives

Supported by digital intelligence technologies, a teacher-student-AI collaborative intelligent teaching is constructed to break the limitations of traditional teaching. Through the implementation of personalized teaching, the integration of teaching resources, and accurate evaluation feedback, students' learning initiative is stimulated, their mastery and application ability of Advanced Mathematics knowledge are enhanced. At the same time, teachers' teaching

strategies are optimized to achieve a dual improvement in teaching quality and efficiency.

2.2. Key Construction Contents

1. Construction of the digital intelligent teaching platform

Build a teaching platform integrating big data analysis and AI intelligent tutoring functions. Real-time data such as students' learning time, answering situations, and interaction frequencies are collected, and learning portraits are generated through algorithm analysis. The platform has an in-built intelligent Q&A system that can instantly respond to students' questions and provide teachers with feedback on the overall learning status of the class and individual students.

2. Optimization of teaching content and resources

Based on the characteristics of digital intelligent teaching, add cases and project-based content that combine with professional applications and real-life situations. Integrate online and offline resources and develop diversified learning materials such as digital textbooks, micro-course videos, and hierarchical exercise questions to meet the learning needs of students at different levels.

3. Design of the collaborative teaching process

Establish a full-cycle collaborative process of "before class - during class - after class". Before class, teachers analyze preview data based on the platform and formulate personalized teaching plans. During class, teachers lead the teaching guidance, AI provides real-time assistance, and students are deeply involved in interactive exploration. After class, students independently consolidate through the platform, and teachers carry out targeted tutoring based on data feedback.

2.3. Core Innovation Points

Innovation in the teaching: Break through the traditional model dominated solely by teachers and construct a three-party collaborative mechanism of teacher-student-AI. Teachers play a guiding and decision-making role, students become active learners, and AI undertakes functions such as auxiliary Q&A, data collection, and analysis, forming a teaching community with complementary advantages.

Innovation in teaching resources: Create a resource supply system of "basic resources + personalized recommendations". The platform accurately pushes cases and exercises that match students' knowledge weaknesses through big data analysis, improving the utilization efficiency of resources.

Innovation in teaching evaluation: Establish a multi-dimensional evaluation system covering indicators such as learning behavior, attitude, and knowledge mastery. Combining process data and result-based assessments, accurate quantification and dynamic monitoring of teaching effectiveness are achieved.

3. Practical Path of the Teaching

3.1. Planning of the Practical Teaching

Initiation and research stage. Form a project team, conduct research on the needs of teachers and students, clarify teaching pain points and improvement directions, and complete the framework design of the teaching platform.

Construction and design stage. Promote the construction of the core functions of the teaching platform, complete the optimization of teaching content and the preliminary design of the collaborative teaching process, and form a stage teaching resource package.

Testing and improvement stage. Carry out small-scale teaching pilots in some classes, test the stability of the platform and the feasibility of the teaching process, collect feedback and optimize the platform functions and teaching plans, and establish a preliminary evaluation system.

Summary and promotion. Comprehensively summarize practical experience and sort out the theoretical and practical achievements of the teaching.

3.2. Core Problems

Breaking the dilemma of a single teaching: Enhance the flexibility and interest of teaching through the integration of online and offline blended teaching, interactive exploration, and personalized learning.

Compensating for the shortcoming of personalized teaching: Rely on big data analysis to generate students' learning portraits, formulate exclusive learning paths for individuals, and meet the development needs of students with different foundations.

Improving the accuracy of teaching evaluation: Leverage digital intelligence technologies to achieve real-time collection and analysis of learning process data, providing a scientific basis for teachers to adjust teaching strategies.

4. Practical Effects and Achievements

Digital intelligent teaching tools and interactive teaching scenarios stimulate learning interest. Personalized tutoring and hierarchical resources improve knowledge mastery, significantly increasing learning participation and course satisfaction.

The platform's data feedback simplifies the process of analyzing students' learning situations. The AI auxiliary function reduces the burden of repetitive work, enhances the pertinence of teaching plans, and significantly improves teaching efficiency.

An intelligent teaching system that can be continuously optimized is formed. The teaching quality of the course is steadily improved, providing a demonstration for the reform of similar basic courses.

5. Conclusions and Prospects

The teacher-student-AI collaborative intelligent teaching in the context of digital intelligence has achieved all-round innovation in the teaching of Advanced Mathematics through technological empowerment, effectively solving the core pain points in traditional teaching. This is student-centered, relying on technological support and teacher guidance to construct an efficient and collaborative teaching ecosystem, providing a new perspective and path for the teaching reform of basic courses.

In the future, the accuracy of the AI algorithm of the teaching platform will be further optimized, the resources of interdisciplinary teaching cases will be expanded, and the connotation and application scenarios of the collaborative teaching model will be deepened. At the same time, the practical effects will be continuously tracked, the evaluation system will be improved, and the model will be promoted in more basic courses to contribute to the digital intelligence transformation of Advanced education and the improvement of talent cultivation quality.

Acknowledgments

This work was supported in part by the 2024 Educational and Teaching Reform Project of Beijing Wuzi University (2024jgxm24840), in part by Innovation and Entrepreneurship Training Program for College Students(202501040K001).

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