

PEDAGOGICAL SCIENCES

AN EXPLORATION OF THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN JUNIOR HIGH SCHOOL MATHEMATICS CLASSROOM TEACHING

Zhao Long,

Shuguang Middle School, Jining District, Ulanqab, 012000, Inner Mongolia, P. R. China

Wang Rui,

Shuguang Middle School, Jining District, Ulanqab, 012000, Inner Mongolia, P. R. China

Zhang Lixia,

Shuguang Middle School, Jining District, Ulanqab, 012000, Inner Mongolia, P. R. China

Xue Lihong,

School of Mathematics and Statistics, JiNing Normal University,

Ulanqab, 012000, Inner Mongolia, P. R. China

Zhang Wei

School of Economics and Management, JiNing Normal University,

Ulanqab, 012000, Inner Mongolia, P. R. China

Funded Project: Ulanqab City 2025 Basic Education Special Project 'Research on Interdisciplinary Smart Teaching Models for Junior High School Mathematics in an Artificial Intelligence Environment (WLCBJC202507)'

<https://doi.org/10.5281/zenodo.15879894>

Abstract

Artificial intelligence (AI) is profoundly transforming the teaching model of junior high school mathematics classrooms, opening up new avenues for personalised learning, classroom interaction, and improved teaching effectiveness. This paper first discusses the necessity of applying AI to junior high school mathematics teaching, then analyses the current issues in teaching, and finally focuses on exploring specific application strategies for AI in classroom teaching, with the aim of providing references for enhancing teaching effectiveness.

Keywords: artificial intelligence; junior high school mathematics; classroom teaching; application exploration

1 The necessity of applying artificial intelligence in junior high school mathematics teaching

In the digital age, the rapid development of artificial intelligence technology has brought unprecedented opportunities to the field of education. As a key component of basic education, the quality of junior high school mathematics teaching directly affects students' mathematical literacy and future learning abilities. The application of AI in junior high school mathematics teaching can not only effectively improve teaching efficiency, but also significantly optimise the learning experience of students. Through data analysis and intelligent algorithms, AI can accurately identify students' learning needs and weaknesses, thereby generating personalised learning plans. This model effectively compensates for the shortcomings of traditional teaching, enabling each student to learn at their own pace and in their own way. At the same time, AI-assisted teaching tools can create complex mathematical problem scenarios to help students understand and master abstract concepts more intuitively.

2 Current issues in junior high school mathematics teaching

(1) Lack of practicality and innovation in teaching content

Teaching content is disconnected from practical application, making it difficult for students to transfer knowledge to real-life situations and future career scenarios. Traditional teaching methods not only weaken

students' interest in learning, but also constrain the development of their practical skills and innovative thinking.

(2) Teaching methods are monotonous and lack diversity and interactivity

The traditional lecture-based teaching model places students in a passive role, depriving them of opportunities for active thinking and exploration. This one-way method of imparting knowledge fails to stimulate students' interest and enthusiasm for learning, often resulting in a dull classroom atmosphere and poor learning outcomes.

(3) Incomplete evaluation system, emphasising grades over ability

The current evaluation system relies too heavily on exam results and lacks effective assessment of students' comprehensive qualities and practical abilities. This single evaluation method cannot fully reflect the learning situation and is likely to induce students to focus on exam-oriented learning, neglecting the cultivation of mathematical thinking and problem-solving abilities.

3 Practical Application of Artificial Intelligence in Junior High School Mathematics Teaching

Currently, various AI-based math teaching tools and platforms (such as smart classroom platforms, online tutoring systems, adaptive learning software, etc.) are widely used in teaching practice. These tools rely on algorithms to provide students with customized

learning content and difficulty levels, and adjust teaching strategies in real time based on learning progress and feedback.

3.1 Intelligently generate learning content to stimulate intrinsic motivation to learn

Interest is a key motivator for learning mathematics. Teachers should fully consider students' interests and use AI technology to dynamically generate learning content tailored to the classroom, allowing students to enhance their motivation to learn and improve the quality and effectiveness of learning in an interesting context.

Case Study: In teaching 'linear equation with one unknown', teachers discovered that students were very interested in the market economy and used AI to introduce relevant case studies to design application questions:

The school bookstore plans to purchase best-selling books, with each book costing 20 yuan to purchase and selling for 30 yuan. The monthly fixed costs (such as rent) amount to 1,000 yuan. Question: If 300 books are sold this month, what will be the profit? If the target profit for this month is 5,000 yuan, how many books need to be sold?

This case study integrates students' interests, effectively stimulating their enthusiasm for learning and encouraging them to make connections. Through analysing the case study, students master mathematical knowledge and its application methods, improving their mathematical modelling and problem-solving abilities. At the same time, the case study involves economic concepts such as 'cost, selling price, sales volume, and profit,' which helps students understand business logic and market rules, cultivates their economic awareness and comprehensive literacy, and provides an opportunity for interdisciplinary knowledge integration. Teachers can tailor learning content based on students' diverse interests using AI to continuously design and adjust materials, guiding efficient exploration.

3.2 Innovative teaching methods promote open inquiry-based learning

Traditional teaching methods focus on imparting knowledge and skills, often neglecting to stimulate interest. AI can use gamified learning, virtual experiments, interactive question-and-answer sessions, and other methods to make abstract mathematical concepts vivid and interesting, allowing students to actively acquire knowledge in a relaxed atmosphere. This fun and educational approach not only improves learning outcomes but also cultivates interest in learning and a spirit of inquiry.

(1) Transform the teaching model: teacher-led, student-centred

To motivate students and clarify the application of knowledge, a new teaching model can be constructed:

First, use artificial intelligence to recreate the knowledge being taught in a real-world context. Then, establish a mathematical model to derive a formula or property. Next, prove or derive the conclusion. Finally, expand the application through numerical simulation or case analysis. This teaching model can be summarised as: create a scenario (AI recreates the real-world context) → establish a mathematical model → derive and

deduce → expand the application (AI-assisted numerical simulation/case analysis).

(2) Enhancing interactivity and collaboration

AI technology can significantly enhance the interactive experience of mathematics learning. Students participate in virtual experiments (such as tossing a virtual coin 100 times and observing the frequency of heads), gamified learning (such as solving quadratic equations through a 'challenge-based quiz'), and real-time Q&A sessions through intelligent teaching systems, thereby stimulating interest and increasing engagement. Additionally, AI facilitates collaborative learning among students (such as online discussions and collaborative problem solving), fostering teamwork and communication skills.

(3) Personalised teaching based on intelligent systems

Before class, teachers can use the app to post relevant questions so that students understand the focus of the next day's learning, thereby improving the effectiveness of their preparation through targeted previewing. In practice, teachers can use the app to send specific questions to students' smart devices. Students use this device to complete their pre-class assignments and submit them via a mobile app. The system automatically evaluates and provides feedback on their pre-class results. Teachers can conduct a comprehensive analysis of these results to identify areas where students need improvement during pre-class preparation, enabling them to adjust the focus of classroom instruction and allocate teaching time appropriately across different sections. This approach facilitates the implementation of personalised teaching strategies. For example, when teaching the section on 'Fractions and Their Applications', teachers can set different questions for students and guide them to complete corresponding exercises. During classroom teaching, teachers can flexibly adopt a variety of teaching methods and techniques based on students' listening and interaction, such as adding group competition sessions to enhance students' participation and interaction.

3.3 Specific Application Scenarios for Technical Support

(1) Intelligent Diagnosis

Artificial intelligence collects and analyses students' answer data and learning behaviour patterns in real time to construct a multidimensional profile of their learning situation, enabling accurate diagnosis of their knowledge mastery and cognitive characteristics. The system not only automatically generates personalised learning path recommendations to help students form a clear self-awareness, but also provides teachers with class-wide learning situation reports and individual difference analyses to assist them in dynamically adjusting their teaching strategies. Specific application scenarios include:

Implementation of differentiated instruction: Teachers can use the learning reports generated by the system to set differentiated tasks (such as basic, advanced, and extension groups) in classroom exercises and push smart exercise sets that match students' abilities after class to achieve precise teaching.

Wrong Question Management System: The system automatically collects wrong questions and labels the types of errors (such as conceptual, computational, or comprehension errors). After completing a unit, it generates a review manual of wrong questions, and teachers can guide students to conduct targeted intensive training.

Dynamic difficulty adjustment: Based on students' real-time performance, the difficulty level of questions is intelligently adjusted to ensure that exercises remain within the 'zone of proximal development'. Adaptive training continuously improves learning efficiency.

(2) Building personalised learning paths

AI-based personalised learning paths are built using intelligent algorithms to create learning trajectories tailored to students' cognitive characteristics and development needs. The system mainly performs the following functions:

Learning diagnosis: Real-time monitoring of key indicators such as students' answering speed and accuracy, and intelligent identification of error types (e.g. calculation errors, conceptual confusion, logical deviations).

Precise intervention: Push customized learning resources (such as micro-lesson videos, specialised exercises, and error analysis) targeting knowledge gaps.

Path optimisation: Recommend the optimal learning sequence based on students' interests and cognitive styles.

(3) Visualisation of abstract concepts

Use AI-driven dynamic geometry tools (such as the GeoGebra AI plugin) to generate function images or geometric transformation animations via voice commands (e.g. demonstrate the effect of moving the vertex of a quadratic function on the image).

(4) Real-time monitoring and early warning of student learning situations

Combining cameras and AI to analyse students' expressions in class (such as confusion or concentration) and remind teachers to adjust the pace of teaching in a timely manner. Based on historical data, predict students' academic risk points (such as weak areas in mid-term exams) and push review materials in advance for intervention.

Conclusion

Artificial intelligence has profound practical significance and broad development prospects in junior

high school mathematics education. Through means such as personalised learning, intelligent tutoring, and data analysis, AI can significantly improve student learning effectiveness and teacher teaching efficiency. However, its application still faces challenges such as insufficient teacher knowledge and skills, room for improvement in the practicality of tools, and varying levels of student acceptance. In the future, with the continuous advancement of technology and deeper exploration of practical applications, artificial intelligence will undoubtedly play a more central role in junior high school mathematics education, providing strong support for the cultivation of high-quality talent.

References:

1. Wu Di, Yuan Zhongguo, Jiang Guodong. Cross-disciplinary course design and classroom teaching of artificial intelligence in primary and secondary schools: A case study of 'Mathematical Modelling in Artificial Intelligence' [J]. *Information Technology Education in Primary and Secondary Schools*, 2022(06):69-73.
2. Zhao Hongfu. A Preliminary Discussion on the Modernisation and Intelligence of Junior High School Mathematics Education: The Integration and Practical Application of Artificial Intelligence [J]. *Examination Weekly*, 2024(10):67-71.
3. Cai Ruman. The Application of Artificial Intelligence in Junior High School Mathematics Classroom Teaching [J]. *Mathematical World (Lower Half-Monthly)*, 2024(11):80-82.
4. Zhang Juanbo, Liu Hailan. The Deep Integration of Junior High School Mathematics Teaching and Artificial Intelligence Technology [J]. *Tianjin Education*, 2025(04):17-18.
5. Han Yanbing. Optimisation of Junior High School Mathematics Teaching Methods through Artificial Intelligence Technology [J]. *Science Consultation*, 2024(08):119-122.
6. Zeng Pengzhi. Effective Application of Artificial Intelligence in Junior High School Mathematics Teaching [A]. *Guangdong Provincial Electronic Society. Proceedings of the 2024 (Second Half) 'Electronic Technology and Information Science' Symposium [C]. Guangdong Provincial Electronic Society: Guangdong Provincial Electronic Society, 2025: 4. DOI: 10.26914/c.cnkihy.2025.006721.*