Research on the Path of Empowering Mathematics Basic Education with Artificial Intelligence

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Abstract: *With the rapid development of technology, artificial intelligence has gradually penetrated into the field of education, bringing new opportunities and challenges to mathematics basic education. This article takes mathematics basic education as the starting point to explore the path and practice of empowering mathematics basic education with artificial intelligence. Covering aspects such as leadership attention, system support, teacher leadership, student centeredness, parental understanding, and project guidance, the aim is to fully leverage the advantages of artificial intelligence through multi-party collaboration, and improve the quality of mathematics teaching and student learning outcomes.*

Keywords: Artificial intelligence, Mathematics, Elementary education, Path analysis.

1. Introduction

Mathematics, as a core subject in basic education, plays a crucial role in cultivating students' logical thinking, problem-solving, and innovative abilities. However, traditional mathematics education faces many challenges, such as difficulty in meeting students' personalized needs through large class teaching, single teaching methods leading to low learning interest, and uneven distribution of teaching resources. The emergence of artificial intelligence, with its powerful data processing, intelligent analysis, and simulation capabilities, is expected to break through these bottlenecks and reshape the ecology of mathematics basic education.

2. The Path of Empowering Mathematics Basic Education with Artificial Intelligence

2.1 Leaders Attach Importance to: Laying the Foundation for Intelligent Tutoring

Education departments and school leaders should fully recognize the importance of artificial intelligence in mathematics education and incorporate it into school development strategic planning. Firstly, it is necessary to increase investment in artificial intelligence education infrastructure, including the purchase of advanced hardware equipment such as intelligent teaching terminals, servers, etc., to ensure the smooth operation of intelligent tutoring systems. Secondly, actively organize teachers to participate in artificial intelligence education training to enhance their information literacy and application abilities, thereby providing teacher support for subsequent teaching practices. The importance of leadership is also reflected in establishing and improving relevant incentive mechanisms, rewarding teachers who actively apply artificial intelligence in teaching, encouraging teachers to innovate and explore intelligent tutoring models suitable for students in the school, thus creating a good atmosphere for actively applying artificial intelligence at the school level and laying a solid foundation for the development of intelligent tutoring.

2.2 System Support: Building an Intelligent Tutoring Platform

A powerful intelligent tutoring system is the key to empowering mathematics education with artificial intelligence. The system should have the following functions. The first is the precise knowledge diagnosis function, which utilizes big data algorithms and machine learning technology to accurately locate students' knowledge gaps and weak links by collecting and analyzing students' learning data, such as homework completion status, test scores, classroom interaction performance, etc. This diagnostic function can provide a basis for personalized counseling. The second is a rich library of learning resources, covering videos explaining mathematical textbook knowledge points, animated demonstrations, massive practice questions, and expanded reading materials, which can meet the learning needs of different students. The third is the intelligent Q&A function, which uses natural language processing technology to understand students' questions and provide detailed answers and problem-solving ideas in a simple and understandable way, achieving real-time online tutoring. At the same time, the system should have good compatibility and ease of use to facilitate the operation and use of teachers and students, and be able to continuously optimize and upgrade according to the actual teaching situation, ensuring stable and efficient platform support for mathematical intelligent tutoring.

2.3 Teacher Led: Control the Direction of Intelligent Tutoring

In the process of AI assisted mathematics teaching, the leading role of teachers is irreplaceable. Teachers should have a deep understanding of the functions and characteristics of intelligent tutoring systems, and plan teaching activities reasonably based on mathematics curriculum standards and teaching objectives. In classroom teaching, teachers should provide targeted explanations and breakthroughs in difficult points based on the feedback of students' learning situation from the system, guiding students to correctly use intelligent tutoring tools for self-directed learning. For example, when explaining mathematical theorems, teachers use animated demonstrations in intelligent systems to assist teaching, allowing students to understand the derivation process of theorems more intuitively. Then, relevant exercises are assigned to students to complete and view feedback in a

timely manner on the intelligent system. Teachers then summarize and generalize students' answer situations to strengthen their mastery of knowledge. In addition, teachers should pay attention to students' learning status and psychological changes, avoid excessive reliance on intelligent tutoring systems, cultivate students' ability to think independently and solve problems, and ensure that intelligent tutoring always serves the fundamental goal of mathematics teaching, which is to enhance students' mathematical thinking and comprehensive literacy.

2.4 Student Centeredness: Inspiring the Vitality of Intelligent Tutoring

Students are the direct beneficiaries and participants of intelligent tutoring, and their main role should be fully utilized. Students should be encouraged to actively use intelligent tutoring systems for self-directed learning, arrange their study time reasonably based on personalized learning plans generated by the system, and provide targeted reinforcement training for weak knowledge points. Students should learn to ask questions, interact and communicate with intelligent systems, and explore the connotation and application of mathematical knowledge in depth during the process of use. For example, when learning mathematical application problems, students use intelligent systems to provide prompts and guidance, attempt to analyze problems from different perspectives, construct mathematical models, solve answers, and compare various problem-solving methods provided by the system to broaden their problem-solving ideas. At the same time, students can use intelligent systems to engage in collaborative learning, discuss mathematical problems together, share learning experiences and insights, create a good learning atmosphere, stimulate the vitality of intelligent tutoring in mathematics learning, and improve learning effectiveness.

2.5 Parents' Understanding: Creating an Intelligent Tutoring Environment

Parents play an important role in their children's education process, and they need to understand and support artificial intelligence assisted mathematics teaching. Schools should strengthen communication with parents and introduce the advantages and implementation methods of artificial intelligence in mathematics teaching through parent teacher conferences, special lectures, and other forms, so that parents can understand how intelligent tutoring systems can help students improve their academic performance and learning abilities. Parents should actively cooperate with schools to create favorable conditions for students to use intelligent tutoring systems at home, such as providing a stable network environment and arranging study time reasonably. At the same time, parents should pay attention to their children's learning process and progress, maintain close contact with teachers, and jointly guide students to use intelligent tutoring tools correctly, avoid students becoming addicted to electronic devices or being disturbed by negative information, create a home environment conducive to students' intelligent tutoring learning, and promote students' continuous progress in mathematics learning.

2.6 Project Leadership: Promoting Innovation in

Intelligent Tutoring

Guided by research projects, exploring in depth the intelligent tutoring paths and methods of empowering mathematics basic education with artificial intelligence is an important measure to promote innovative development in education. Schools and teachers should actively apply for relevant projects and conduct research on the application effect, teaching mode innovation, and student learning behavior analysis of intelligent tutoring systems in mathematics teaching. By conducting research on the topic, summarizing practical experience, identifying existing problems, and proposing targeted solutions, theoretical support and practical guidance are provided for the optimization and promotion of intelligent tutoring.

3. The Problems and Challenges Faced by Artificial Intelligence Empowering Mathematics Basic Education

3.1 Ethical Issues in Technology

On the one hand, artificial intelligence collects a large amount of learning data from students, which poses a risk of data leakage. Once leaked, it will violate students' privacy. On the other hand, excessive reliance on artificial intelligence may weaken students' creativity and independent thinking abilities, leading to a "technology dependency syndrome". How to utilize technological advantages while ensuring students' physical and mental health development is an urgent ethical issue that needs to be addressed.

3.2 Difficulty in Changing Teacher Roles

The entry of artificial intelligence into mathematics classrooms has challenged the dominant position of teachers in imparting knowledge. Some teachers find it difficult to adapt to the role transition from "knowledge transmitters" to "learning guides" and "learning designers", lacking the ability to use artificial intelligence technology to design teaching plans and guide students to learn through technology, resulting in obstacles to the integration of artificial intelligence and mathematics teaching practice.

3.3 Unequal Distribution of Educational Resources

Although artificial intelligence has the potential to improve the unequal distribution of educational resources, currently in some economically underdeveloped areas, due to weak infrastructure and insufficient funding, it is difficult to popularize AI educational equipment and software, resulting in a further widening gap in mathematics education between urban and rural areas and regions, which violates the principle of educational equity.

4. Response Strategies and Suggestions

4.1 Strengthen the Supervision of Technical Ethics

The government and education departments should establish strict regulations on the protection of artificial intelligence education data, requiring enterprises and schools to adopt

encryption, anonymization and other technological means to ensure the security of student data. At the same time, teachers are encouraged to reasonably control the duration and frequency of artificial intelligence use in teaching, design teaching activities that cultivate students' creativity, guide students to view technology dialectically, and avoid excessive dependence.

4.2 Assist Teachers in Their Professional Growth

Carry out artificial intelligence education and training programs for teachers, using a combination of online and offline training methods to enhance their technical literacy, including the use of artificial intelligence tools, data analysis skills, etc. Organize teachers to observe demonstration classes of artificial intelligence empowering mathematics teaching, share and exchange successful experiences, and encourage teachers to actively integrate artificial intelligence into teaching practice, achieving a smooth transformation of the teacher's role.

4.3 Promote Balanced Allocation of Educational Resources

The government should increase funding for the construction of educational informatization in rural and remote areas, improve network infrastructure, and create conditions for the implementation of artificial intelligence education. Enterprises should be encouraged to develop low-cost and easy-to-use artificial intelligence education products, and donate or offer discounts to schools in poverty-stricken areas; Paired assistance activities between urban and rural schools should be carried out, which can share artificial intelligence education resources and practical experience, and gradually narrow the education gap.

5. Conclusion

The empowerment of mathematics basic education by artificial intelligence has shown great potential, and the intelligent tutoring path of AI empowerment of mathematics basic education requires the collaborative cooperation of leaders, systems, teachers, students, parents, and research projects. Only when all parties fully play their respective roles and form an organic whole, can the effective application of artificial intelligence in mathematics teaching be truly realized, providing students with higher quality, efficient, and personalized mathematics education services, and promoting the development of mathematics basic education towards intelligence and modernization. However, to achieve a deep integration of artificial intelligence and mathematics basic education, it is still necessary to overcome many problems such as technological ethics, teacher role transformation, and unequal distribution of educational resources. Only through the collaborative efforts of the government, enterprises, schools, and teachers, seeking benefits and avoiding harm, can artificial intelligence truly become a powerful force in promoting the high-quality development of mathematics basic education and cultivating innovative mathematics talents that meet the needs of future society. In the future, with the continuous advancement and improvement of technology, artificial intelligence will play a more outstanding role in the field of mathematics basic education, opening a new chapter in education.

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