

Research on innovative teaching methods of the primary school mathematics curriculum in the background of education digitalization

Ge Ge*

Normal College, Xuzhou University of Technology, Xuzhou, Jiangsu, 221018, China

Abstract. In the trend of digital education, the mathematics courses in middle schools and colleges are particularly popular with researchers, but less attention has been paid to the innovation of digital teaching methods in primary school mathematics courses. The paper analyzes the impact of digital education on primary school mathematics teaching and the possible challenges of innovating digital teaching methods of primary school mathematics. The paper analyzes that under the background of digital education, the teaching objectives of primary school mathematics, students' learning methods and the role orientation of teachers will change. The lack of digital literacy of teachers, uneven quality of digital education resources and imperfect digital hardware equipment will hinder the innovation of digital teaching methods of primary school mathematics. Therefore, the paper proposes three strategies: integrating digital teaching and project-based teaching, visualizing abstract knowledge and creating virtual scenes.

1 Introduction

The mathematics curriculum standard for compulsory education published in 2022, points out that teachers should pay attention to the combination of artificial intelligence and mathematics teaching to improve teaching methods. In the same year, the Ministry of Education issued the "digital literacy of teachers" standard, which requires teachers to have the ability to apply digital technology resources in teaching activities. In this context, whether teachers can use and how to use digital application tools to innovate teaching methods in primary school mathematics is a practical problem worth exploring.

The scholar Bu Hongxiao used the case analysis method to find that the digital transformation of basic education has achieved remarkable results. The digital transformation of education promotes the improvement of students' education methods, it also improves teaching efficiency and reduces the work pressure of teachers [1]. Through literature review, scholar Cong Xiangfei discussed the value, challenges and methods of developing teaching resources for College Physical Education Curriculum under the background of digital education. The research showed that the construction of digital education resources was conducive to stimulating students' interest in learning, and also conducive to improving the digital literacy of

* Corresponding author: gege@xzgcxy.wecom.work

teachers [2].

Previous scholars mainly focused on researching the role of digital education, the construction and development of digital education resources, etc., but less on the innovation of teaching methods in the digital background, especially the discipline-focused research in the primary education stage. Therefore, the paper will focus on the impact, challenges and strategies to explore the innovation of primary school mathematics teaching methods in the context of digital education.

2 The impact of digital education on primary school mathematics teaching

2.1 Changes in teaching objectives

The mathematics curriculum standard for compulsory education emphasizes the need to improve the ability of pupils to discover, propose, analyze and solve problems, which is intended to enable teachers to closely link mathematics knowledge with real life, so that students can learn to apply mathematics knowledge to problem solving and obtain life experience [3].

With the development of the Internet and intelligent devices, students can access a large number of mathematical resources on the Internet every day, which makes students' learning knowledge richer. Mathematical knowledge can also be more closely integrated with the knowledge of various disciplines, and it is more closely related to real life.

The development of digital learning tools such as massive open online courses and virtual laboratories has also overcome the disadvantages of traditional learning tools, such as limited information capacity and insufficient flexibility. The use of digital learning tools enables students to change from static thinking to active exploration, with more choices of learning tools. Digital learning tools are also more personalized and interactive, which helps students improve their ability to analyze and solve problems.

However, the teaching objectives of the course have changed accordingly at the same time. Students should not only have the ability to deal with problems, but also learn to identify, screen, integrate and extract effective mathematical resources from network resources to avoid being interfered with by wrong and fragmented knowledge. Students should also have certain digital literacy skills, including the ability of data and the application of digital tools.

2.2 Changes in the learning styles of students

The digitalization of education has also promoted the reform of the learning styles of students. With the popularity of digital media, learning is no longer confined to paper textbooks and school classrooms. Students can make up for the shortcomings of traditional learning styles through e-books and MOOCs. Learning is no longer limited by time and space. Students can also choose to learn according to their own needs and interests. Some digital learning platforms will also provide animation, video, and interesting learning games. This learning style emphasizes autonomous learning. It can provide personalized learning resources, arouse the interest of pupils in learning and help students establish the awareness of autonomous learning and the ability of inquiry learning [4].

2.3 Changes in the role orientation of teachers

In the traditional education mode, primary school mathematics teachers mainly transmit knowledge to students through textbooks and blackboard writing. Most students receive knowledge passively and have little right to choose. In the context of digital education, students have various channels to acquire knowledge. Students can acquire mathematical knowledge through MOOCs or various learning apps for autonomous learning. This requires that teachers can not be limited to book knowledge; they need to carry out certain extracurricular extensions. At the same time, teachers should also organize and plan in-class and out-of-class learning, as well as online and offline learning [5]. Teachers also need to change from the knowledge transmitter to the wisdom guide. The class needs to be student-centered and heuristic teaching.

In the past, teaching evaluation was mainly based on academic performance, therefore, most teachers put the education center on the problem-solving skills of mathematical problems, and there was little in-depth explanation of knowledge. In digital education, it is more important to guide in-depth learning of knowledge points than to learn simple mathematical problem-solving methods [5].

3 The challenge of digital teaching method innovation in primary school mathematics

3.1 The lack of digital literacy of teachers

With the emergence and development of digital teaching resources, the Education Department continues to invest and use digital education resources in schools, and many teachers are beginning to change from traditional teaching to digital teaching. However, due to the long-term impact of the traditional teaching mode and the lack of specialized training for the digital literacy of teachers, most teachers are passively accepting digital teaching and lack innovation. Most teachers simply move the teaching content to PowerPoint. Improper digital teaching by teachers will lead to the decline of teaching enthusiasm and the learning effect. The main reasons for this situation are that teachers lack the concept of digital education, the ability to organically integrate digital resources and teaching content, and the ability to deeply learn and apply digital tools with high teaching value but difficult operation, such as mathematical modeling software and intelligent teaching system [6]. In addition, the ability of teachers to guide students in the digital learning environment needs to be improved. In the digital learning environment, students are easily distracted by digital tools, which makes it difficult to grasp the key points in class, and excessive use of digital tools. Teachers should timely manage and standardize the use of digital tools [7].

3.2 Uneven quality of digital education resources

With the popularization of network information technology, the teaching resources of primary school mathematics are growing rapidly, but are also followed by a series of educational problems. The sources of educational resources are more abundant, such as the digital curriculum resources developed by the school itself. Educational app and online education platform developed by professional educational resource providers. Online educational resource platforms such as Tencent Classroom and subject networks will also provide digital resources of various subjects to facilitate lesson preparation and autonomous learning. These digital educational resources are indeed diversified in form, breaking the resource barrier, but some

resources are mere formality and lack academic professionalism, and there may be imperceptible errors. Moreover, some teaching methods of resources are not innovative enough, even contrary to the curriculum standards, and can not keep up with the changes in the syllabus. Some resource developers fail to take into account the needs and interests of primary school students. Some of the developed resources do not conform to the cognitive laws of primary school students, and will be disconnected from school teaching and teaching materials [7]. This leads to the reduction of the effectiveness of teachers' teaching and the improvement of students' learning effect. At the same time, due to the huge base and wide range of digital education resources, teachers need to spend a lot of time collecting and integrating, as well as screening the availability of resources.

3.3 Imperfect digital hardware equipment

The innovation of the digital teaching method is also limited by hardware equipment. Some areas lack necessary digital equipment, especially in rural areas and Western China. Due to imperfect infrastructure construction and low economic capacity, it is impossible to build and optimize digital teaching facilities, resulting in problems such as low network coverage, poor stability, lack of multimedia facilities, lack of supporting facilities, multiple people sharing one equipment, aging hardware, etc. [8]. Therefore, teachers and students can only rely more on traditional textbooks, and the learning content is single and abstract. Lesson preparation is time-consuming and laborious, and the form of classroom interaction is single. Teachers are unable to participate in online teaching, research and training, and lack the conditions for digital education practice. Teachers' digital literacy cannot be improved, and their professional growth is hindered. New teaching concepts and methods such as digital teaching and project-based teaching cannot be implemented.

4 Strategies of primary school mathematics teaching method innovation

In the context of the current digital education, to respond to social needs and improve teaching quality and teaching results, the innovation of primary school mathematics teaching methods is imperative.

4.1 Integrating digital and project-based learning

The innovation of digital education methods can integrate a variety of digital technologies and combine with PBL to strengthen students' ability to cooperate, communicate and solve problems, and enhance students' interest in learning [9].

In the era of digital education, students are more willing to obtain information in the form of multimedia with multi-sensory interaction, and pay more attention to the experience perception generated in the learning process. Therefore, teachers' use of digital teaching tools can improve students' enthusiasm to participate in learning. Primary school mathematics is a scientific subject. Teachers can better combine mathematical knowledge with real-life practice when creating problem situations, and can also stimulate students' desire to actively explore knowledge. At the same time, primary school students are at the core stage of the transformation from concrete thinking to abstract thinking. The combination of mathematics teaching and digitization is conducive to students' in-depth understanding of knowledge.

For example, in the course of teaching the preliminary understanding of decimals, students can be introduced to the situation of daily shopping problems closely related to reality, and

students can be organized to exchange and discuss. At the same time, the use of digital technology to integrate MOOC, multimedia animation presentations, or digital games into teaching is not only conducive to students' in-depth learning, but also can increase the interest of the class and form their unique teaching style [5]. This teaching method of integrating PBL and digital teaching enables students to realize that mathematics is everywhere in life in problem situations, and it also enables students to experience the practical value of mathematics. At the same time, it can exercise students' ability to solve problems by using existing knowledge and experience, and new methods of innovative discussion. In the problem scenario, MOOCs, digital games, and multimedia animation can not only attract students' attention but also make difficult knowledge easier to understand [10].

4.2 Visualizing abstract knowledge

In the primary school mathematics curriculum, some mathematical knowledge is obscure, especially the knowledge points about geometric figures, such as the translation and rotation of figures, and the understanding of three-dimensional figures. Digital teaching can use multimedia animation, dynamic courseware, and other teaching resources, or Scratch, Schiavo interactive whiteboard, GeoGebra and other teaching tools to visualize abstract knowledge, so that students can easily learn the internal logic of mathematical concepts. For example, when learning the characteristics of a parallelogram, students can use GeoGebra to draw a parallelogram, drag four vertices, and change the shape of the parallelogram. Students can intuitively see and understand that the opposite sides of the parallelogram are always parallel and equal. This visual learning method makes students' understanding of knowledge more profound and their memory of knowledge longer. Students can also use Schiavo whiteboard to convert data into charts, so that they can more intuitively understand the relationship between data and charts, and the class is more interactive. However, this teaching method not only requires teachers to have certain digital literacy, but also requires students to operate basic digital learning tools [11].

4.3 Creating virtual scenes

The traditional teaching mode has certain limitations. For example, when teaching the relationship between three-dimensional objects and two-dimensional objects, teachers often use oral explanation or display paper plans, but students find it difficult to understand. The use of virtual reality technology and augmented reality technology to create a virtual scene is a good solution to this problem. Teachers can also directly demonstrate the difference between two-dimensional graphics and three-dimensional graphics in virtual situations, and also let students experience the mystery of mathematics. Through VR technology, students can interact and study deeply with various objects in a complete virtual scene, and students can also enhance their spatial ability. When students use AR technology, although they will not be completely divorced from reality, they can use brushes to add or delete items in real situations. Through these two technologies to promote the formation of students', the incomprehensible mathematical concepts become simple in the virtual scene. At the same time, the high interactivity can stimulate students' desire for academic exploration and improve the teaching efficiency of mathematics teaching.

5 Conclusion

The paper studies the changes under the background of digital education, such as changes in

primary school mathematics teaching objectives and students' learning methods, and points out that the low digital ability of teachers, the uneven quality of digital education resources and some other reasons may bring difficulties to the innovation of primary school mathematics digital teaching methods. Aiming at these two problems, the paper puts forward the strategies of digital teaching methods innovation in primary school mathematics, including injecting digital technology into PBL, visualizing abstract mathematical knowledge using digital technology, and so on. It is expected that this study can provide feasible strategies and a theoretical basis for primary school mathematics teachers' innovative research methods, improve the digital literacy of teachers, improve teaching methods and learning methods, and promote students' all-around development.

References

1. H. Bu, What does digitalization bring to schools? Based on the case study of the Shanghai education informatization application benchmarking school. *China Educ. Technol.* **4**, 32 (2025)
2. X. Cong, Research on the construction and optimization path of digital teaching resources of physical education curriculum in colleges and universities under the background of education informatization 2.0. *Curric. Teach. Methodol.* **7**(10) (2024)
3. D. Wang, Research on the construction strategy of primary school mathematics efficient class under the background of the new curriculum standard. *Famous Teach. Online (Chin. Engl.)* **11**(8), 34 (2025)
4. Y. Sima, Analysis of digital learning methods of mathematics in primary schools. *Math. Phys. Chem. Learn. (Teach. Res. Ed.)* **12**, 61 (2022)
5. W. Cui, J. Du, The role orientation and quality improvement strategy of primary school mathematics teachers from the perspective of educational informatization. *Curric. Educ. Res.* **21**, 197 (2019)
6. C. Zhang, Research on the application strategy of information technology in primary school mathematics teaching. *Math. Learn. Res.* **6**, 134 (2025)
7. M. Wang, The application of digital teaching resources in primary school mathematics class. 2024 Digital Education and Teaching Exchange Conference Proceedings (Part I) 233 (2024)
8. Z. Liu, On the application of digital teaching resources in primary school mathematics classes. *Knowl. Intro.* **11**, 5 (2024)
9. S. F. Miranda, K. B. E., Integrating digital tools to enhance access to learning opportunities in project-based science instruction. *TechTrends* **68**, 882 (2024)
10. D. Yin, Practical research on the deep integration of information technology and primary school mathematics based on project-based learning. Master's thesis, Xinjiang Normal University (2023)
11. Y. Qian, The innovative application of digital teaching in primary school mathematics teaching. *Arts Sci. Navig. (MID)* **3**, 34 (2025)