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Exploration of the Application of Information Technology in Mathematics Curriculum

Qing Zhang*

Beijing Information Technology College, Beijing, China

**Author to whom correspondence should be addressed.*

Abstract: Mathematics is a basic course for cultivating advanced technical talents, a core course for students in the basic education stage, mathematical knowledge content is the foundation of professional courses, mathematical thinking ability is one of the abilities for students' sustainable development, mathematical literacy is a basic quality that students should possess, and it carries the function of implementing the fundamental task of fostering virtue and nurturing talent and developing quality-oriented education. It has the characteristics of being fundamental, developmental, applied, and vocational. In today's era of rapid development of artificial intelligence and big data, mathematics plays a huge role in production and life. This paper briefly expounds and analyzes the current situation of mathematics teaching, explores the significance of information-based teaching for mathematics teaching, and on this basis, proposes relevant strategies for information-based mathematics teaching, including knowledge visualization, the use of information technology to create mathematics teaching scenarios, the realization of efficient mathematics teaching through micro-lessons, and the realization of teaching interaction through network platforms.

Keywords: Information-based teaching; Mathematics teaching; Teaching effectiveness

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1. Introduction

High-end technical and skilled talents are a new type of talent that meets the demands of society for high-quality and high-caliber talents in the new era. Mathematics is a core basic course for cultivating high-end technical and skilled talents, which is of great significance for students to learn professional courses well and improve their comprehensive quality and ability. In teaching practice, many students do not attach enough importance to basic courses like mathematics and have low enthusiasm for learning. The reasons for this problem are multifaceted. Besides individual factors of students, teachers' teaching ideas, models, and methods are also crucial influencing factors. Based on this issue, this paper explores the application of information-based teaching methods in mathematics teaching from the perspective of educational informatization, so as to provide some references for improving the effectiveness of mathematics teaching [1].

2. Analysis of the current state of mathematics teaching

Mathematics, as a core subject connecting basic education and higher education, has a direct impact on the cultivation of students' logical thinking and abstract ability in the context of the current in-depth reform of education and teaching, and presents the characteristics of coexistence of advantages and problems in the current teaching situation. Its advantages are mainly reflected in the trend of diversified teaching methods. While the traditional lecturing method still plays a huge role in the transmission of knowledge, heuristic teaching, inquiry-based teaching, cooperative learning, and other models have also been gradually promoted. Teachers have broken the limitations of a single teaching model by setting up teaching situations and guiding students to actively participate in knowledge learning activities. At the same time, the application of information technology has been initially realized, including knowledge visualization, the use of information technology to create mathematics teaching scenarios, efficient mathematics teaching through micro-lessons, and the use of online platforms for teaching interaction, which have become important means and tools to assist teaching. By using information technology to present abstract concepts and create teaching scenarios, the difficulty for students to understand complex knowledge has been reduced to a certain extent.

3. Practical application of information-based teaching in mathematics teaching

3.1. Realization of knowledge visualization in mathematics teaching

3.1.1. Overcoming teaching difficulties through the combination of numbers and shapes

The combination of numbers and shapes is the core idea that connects abstract algebra with intuitive geometry in mathematics teaching, simplifying complex problems and concretizing abstract ones. The core value lies in lowering the threshold of understanding, transforming abstract numbers and formulas into graphics, allowing students to "see" mathematical relationships and quickly establish conceptual cognition. To enhance problem-solving efficiency, for complex calculations and logical reasoning, the results can be directly observed through auxiliary graphics or the derivation process can be simplified. Cultivate mathematical thinking, help students establish the awareness of the two-way transformation of "number" and "shape," and lay a solid foundation for the subsequent study of advanced mathematics and applied mathematics [2].

3.1.2. Essential teaching tools for the effective implementation of knowledge visualization

To effectively implement knowledge visualization, it is necessary to have the support of effective teaching tools. Basic tools include drawing dynamic graphics with Geometer's Sketchpad, creating data charts with Excel, and using SolidWorks software to assist in verifying solid geometry conclusions.

For example, when explaining the first "important limit," by drawing the graph of the function with Geometer's Sketchpad and observing the corresponding function value y when the independent variable X approaches the origin from the left and right ends of the origin, the conclusion of the first important limit was verified, as shown in **Figure 1**; and verify the numerical calculation results on the computer, as shown in **Figure 2**.

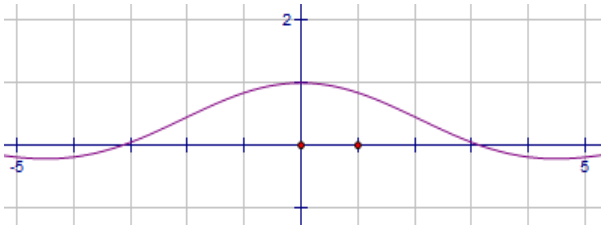

Figure 1. Image verification of the first important limit

$x \to 0$	$\frac{\sin x}{x} \to 1$
0.1	0.998341664682815475018
0.01	0.99998333341666664533527
0.001	0.99999983333333416367097
0.0001	0.99999999833333334174773
0.00000000001	→1

Figure 2. Numerical verification of the first important limit

For example, when explaining "statistical charts," draw a frequency distribution histogram through a frequency distribution table, let students try to read the data features in the table, as shown in **Figure 3**, insert a bar chart, as shown in **Table 1**, and be able to adjust the parameters in the table to observe the changes in the frequency distribution histogram in real time, allowing students to experience the advantages of visualization [3].

For example, when ex plaining solid geometry, by using SolidWorks software to assist in the verification of solid geometry conclusions, by using 3D models to break down section problems, guide students to independently choose three different faces (or points on the edge), draw sections with the "section" tool, and observe the section shapes (triangles, quadrilaterals, pentagons, hexagons). Dynamically adjust the position of the section, let students observe "the relationship between the number of sides of the section and the number of faces it passes through" (if it passes through n faces, the section is an n-sided shape, $n \leq 6$), and analyze the conditions for the existence of the section in combination with spatial imagination. Transform the abstract "spatial cross-section" into a rotatable, observable 3D model, break through the limitations of students' spatial imagination ability, and help them understand the positional relationship of spatial figures.

3.2. Using information technology to create teaching scenarios for mathematics

Situational teaching is a widely used teaching method at present, which is intuitive, vivid, and highly interesting. Moreover, many of the situational settings are closely related to students' daily lives, which is conducive to enhancing students' learning interest and participation enthusiasm. However, conventional context settings are limited by real-world conditions and are not applicable to all teaching contents or teaching units, which limits their application scope to a certain extent. The use of information technology can effectively address this problem and enhance the application effectiveness of the context-based teaching method. For example, when teaching conic sections, teachers can use network technology and multimedia courseware to introduce a story context—the construction of China's Five-hundred-meter Aperture Spherical Telescope (FAST)—to create a context based on the location, shape, function of the FAST and the stories of famous people behind it, thereby stimulating students' interest in learning the course content.

Take everyone into the wonderful world of conic sections through a magical animation. As the animation shows, a plane cuts the cone from different angles. When the angle between the plane and the axis of the cone is different, the profile line of the section where the plane intersects the cone takes on the shapes of ellipses, hyperbolas, and parabolas, respectively. Through these vivid demonstrations and detailed explanations, students have a preliminary intuitive understanding of conic sections, and the basic concepts and images of conic sections begin to form in their minds [4]. A deeper understanding of the close connection between China's FAST and conic sections, the reflective surface of FAST uses the optical properties of ellipses to converge weak radio signals from the universe into the feed chamber, thus enabling us to capture information from the depths of the universe, fully demonstrating the key role of mathematical knowledge, especially conic section theory, in major

scientific projects, Mathematics is not just about formulas and theorems in books; it is a powerful tool for advancing science and exploring the unknown world.

Table 1. Frequency distribution table

Group	Frequency	Frequency	Frequency/group spacing
[0, 2]	2	0.02	0.01
[2, 4]	5	0.05	0.02
[4, 6]	13	0.12	0.06
[6, 8]	19	0.18	0.09
[8, 10]	24	0.22	0.11
[10, 12]	15	0.14	0.07
[12, 14]	18	0.17	0.08
[12, 14]	10	0.09	0.05
[16, 17]	2	0.02	0.01
Combined	108	1	

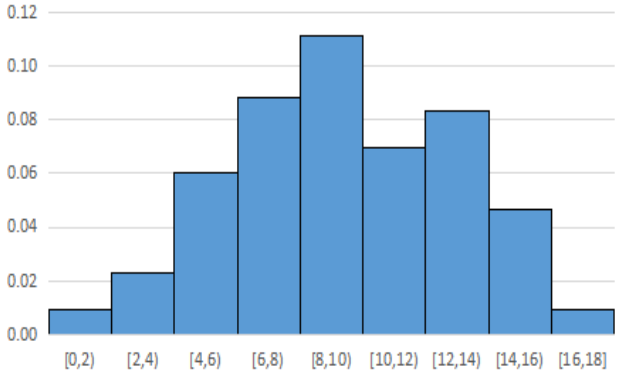

Figure 3. Frequency distribution histogram

3.3. Efficient teaching of mathematics through micro-lessons

3.3.1. Functional advantages of micro-lessons

Micro-lessons have been proven to be an efficient teaching method based on the application of information technology. They have achieved remarkable results not only in technical and operational practical teaching, but also have good application results in basic teaching. Micro-lessons are characterized by their concise and vivid content, distinct themes, and the ability to facilitate fragmented learning, which is in line with the learning behaviors and habits of contemporary students. In mathematics teaching, teachers can make key and difficult issues in teaching into short and concise micro-lesson resources and publish them on the Internet for students to download, use, and study. At the same time, they can build a curriculum system based on micro-lessons and keep the content of micro-lessons interrelated to ensure the overall effectiveness of teaching.

3.3.2. Analysis of typical application cases of micro-lessons in mathematics teaching

Different courseware corresponds to different teaching objectives. Micro-lessons can serve as teaching resources for students to preview before class and review after class, and unit courseware can serve as teaching re-

sources for students to consolidate knowledge and solve difficult problems [5]. This can effectively enhance the effectiveness of teaching. It is worth noting that such micro-lesson designs can form two sets of micro-lesson curriculum systems, one for regular teaching and the other for efficient review. The resources are posted on the online learning platform.

For example, the general term formula of arithmetic sequences and geometric sequences, through examples such as the width of the steps of the Egyptian pyramids and the radius of the Temple of Heaven in Beijing, summarize the definition of arithmetic sequences, derive the general term formula, distinguish the multiplicative terms of arithmetic and geometric sequences by color marking, and dynamically demonstrate the elimination process of subtraction with misplacement.

3.4. Using the online platform for interactive teaching

Many studies have shown that good teaching interaction plays an important role in promoting teaching outcomes and is conducive to creating a good teaching atmosphere and improving teacher-student and student-student relationships. Our traditional teaching interaction is mainly concentrated in classroom teaching. Constrained by the limited teaching time in the classroom, teaching interaction has always been a weak link in classroom teaching. Information-based teaching provides a good way to improve this situation. Through online platforms and instant communication tools, teaching interaction breaks through the spatial and temporal limitations of traditional teaching. The most frequently used approach is to use the Learning Pass platform for interactive teaching, combining the platform's functional features with the characteristics of the mathematics discipline, and enhancing student engagement and learning outcomes through diverse designs. Preview before class, accurately identify the learning situation, and stimulate learning interest; Classroom interaction, multimodal activity design, and enhanced thinking collisions; After-class consolidation, personalized homework, and precise tutoring; Data-driven learning situation analysis, and teaching optimization. For example, in solid geometry teaching, a 3D animation demonstration of the structural features of prisms and pyramids is pushed before class, and students are asked to describe similar geometric bodies in life in the discussion area; In class, students are asked to take pictures of real objects using Learning Pass and mark the geometric elements through "group tasks," and the teacher summarizes after group evaluation; After class, a virtual experiment assignment of "restoring geometry with three views" was posted, and students submitted screen shots of the modeling process via Learning Pass.

4. Conclusion

The application of information technology in mathematics teaching should take into full account students' learning conditions and the applicability and fit of the technology application. As the saying goes, "The art of application lies in the heart," which undoubtedly places higher demands on teachers' information technology teaching literacy. From the perspective of educational informatization, the application of technology is only a primary application. The higher level of information-based teaching is to build new teaching models and methods based on the application of information technology, and to view and solve educational and teaching problems with information-based thinking. This is the essential connotation and significance of information-based teaching.

Disclosure statement

The author declares no conflict of interest.

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