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The Application of Modern Information Technology in High School Mathematics Teaching

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Abstract **– With the rapid development of modern science and technology and the deepening of the new curriculum reform, modern information technology has become an important means to improve the efficiency of classroom teaching. In this context, how teachers use modern information technology to stimulate students' learning motivation, cultivate students' creative thinking, and improve the teaching quality of high school mathematics have become a top priority in teaching. This paper analyzes the application of modern information technology in mathematics teaching and puts forward the corresponding countermeasures according to the analysis of existing problems in the application process.**

Keywords **– Modern Information Technology, Multimedia Technology, High School Mathematics, Teaching Quality.**

I. INTRODUCTION

In the senior high school teaching stage, mathematics is a subject integrating basic and instrumental features, which is characterized by abstraction and symbolization. In the traditional teaching, teachers often ignore students' ability to accept, resulting in the loss of students' confidence in mathematics learning. As a result, mathematics has become a subject that students are relatively resistant to. If the teaching method is not correct, students will easily become weary of learning. With the deepening of the new curriculum reform and the comprehensive implementation of quality education, modern information technology has been widely applied in the field of education. The senior high school mathematics teaching has undergone tremendous changes. The rational application of modern information technology can stimulate students' interest in learning, transform the traditional teaching mode, and optimize the classroom structure, thus improving the quality of mathematics teaching and promoting the development of the field of education. This paper analyzes the role of modern information technology in the teaching process, finds the existing problems, and puts forward corresponding solutions with regard to the existing problems.

II. THE ROLE OF MODERN INFORMATION TECHNOLOGY IN HIGH SCHOOL TEACHING

1. *Stimulate Students' Interest in Learning and Improve their Participation in Class*

Interest is the best teacher, and students are often able to devote all their energy to the subject they are interested in. Mathematics course, as the most abstract subject among all subjects, has the characteristics of formalization, abstraction and symbolization. It is difficult to stimulate students' interest in learning mathematics only by relying on the traditional teaching mode. In the process of learning, students are the subject of learning, and teachers only play a leading role. If students are not interested in the content they are learning, it will lead to low participation in class, and the teaching quality will naturally be difficult to improve. The rational use of modern information technology in the teaching process can provide students with good teaching stimulation in many aspects, stimulate their interest in learning and improve their participation in class [1].

2. *Focus on Students and Change the Traditional Teaching Mode*

The traditional teaching model is based on the teacher, the book and the classroom as a teaching model. In the traditional teaching, teachers often form a one-way transmission of knowledge, students passively accept the phenomenon, which is not conducive to cultivate students' innovative spirit, and also does not meet the requirements of the new curriculum standards. With the development of modern information technology, the traditional teaching mode is gradually changed, student-centered teaching model is improving day by day, and teachers' teaching and students' learning are not only confined to the classroom, which can transcend space, make the teachers impart knowledge to students through network technology at home, but also students can learn at any time and any place through teachers' live broadcast, and students may put forward questions to the teacher through the microphone, thus students' learning initiative has greatly been improved. When students encounter insurmountable difficulties in the process of learning, they can establish face-to-face contact with teachers or classmates. In the process of solving learning difficulties, students will not feel helpless, and teachers will have a better understanding of students' problems and promote their relationship with students. This also greatly alleviates the frustration caused by difficulties encountered by students after class under the traditional teaching method, and improves the efficiency of students' learning on the basis of taking students as the center.

3. *Optimize the Classroom Structure and Improve the Teaching Quality*

A class lasts for 45 minutes. How to use the 45 minutes efficiently becomes the top priority of the teacher's classroom structure design in mathematics teaching activities. Modern information technology is essential to improve the classroom effective utilization technology, reduce effectively the time of the teachers' drawing geometry on the blackboard, the time wasted in copying the questions, which can't be replaced by the traditional teaching mode. In classroom teaching, the reasonable use of modern information technology assisted teaching can optimize the structure of the classroom. Using multimedia technology to design more colorful teaching situation give students a good stimulation, stimulate students' interest in learning, and improve students' learning efficiency, thus improving the quality of teaching. For example, when the new lesson is introduced, we use multimedia technology to design suspense skillfully, so as to attract students' attention, save the time spent importing the new lesson through blackboard writing, and put the saved time on the key teaching, so as to improve the teaching quality.

III. The Main Problems of Modern Information Technology in Mathematics Teaching

1. *The Teacher Relies too much on the Modern Information Technology Teaching, Neglects the Students' main Body Status*

Modern information technology, with its advantages in various aspects, is deeply loved by students and highly praised by teachers. However, in the process of teaching, some teachers fail to choose appropriate modern information technology teaching methods according to the corresponding teaching content and students' characteristics, instead, they over-rely on multimedia teaching and ignore the principle of teaching students according to their aptitude [2]. This has led to such a teaching phenomenon: teachers only need to click on the courseware with the mouse to teach, and use multimedia instead of the blackboard, which is no different from the original traditional teaching method of "cramming". They just become "machine irrigation", while teachers

become commentators, in fact, "wear new shoes to walk on the old road". What's more, no multimedia can't be taught normally, teachers' leading role is ignored, and multimedia is just a tool to assist teaching. This kind of teaching mode will also affect the communication between teachers and students, which is not conducive to the personalized learning and development of students. It ignores the main role of students in learning, and it is also not the original intention of applying modern information technology.

2. *Too Much Emphasis on the Role of Information Technology, Courseware Design Fancy*

With the development of Internet technology, teachers can obtain many excellent teaching resources through the network. It not only brings convenience, but also makes some teachers unilaterally emphasize the display of modern information technology in the classroom in teaching activities. It is easy to form the wrong idea that the application of information technology is in direct proportion to the efficiency of students' learning. At the same time, it also ignores the demonstration role of teachers in the classroom. In order to attract students' interest in learning, some teachers will insert many pictures, videos and special effects when making teaching courseware, hoping to attract students' attention with videos and pictures so that students can actively participate in teaching activities. Instead, all kinds of fancy videos and pictures attract students' attention and make them ignore the important content of this class. This kind of teaching method is not conducive to students' learning of mathematical knowledge.

3. *Teachers Fall Behind in the Concept of Modern Information Technology and Lack of Theoretical Learning*

Modern information technology represents a new teaching model, which should be guided by new teaching concepts. However, some teachers believe that the teaching technology is advanced, so the educational concept is advanced naturally [3]. Therefore, there is a phenomenon of using backward teaching concepts to guide advanced teaching techniques. Some teachers ignore the study of educational theory and have a special liking for the application of modern information technology, but they don't pay enough attention to the advanced modern educational theory. Without the importance of learning modern educational theories, the traditional "cramming" teaching mode under the cloak of modern information technology has emerged, which will make classroom teaching monotonous, boring and lifeless, and the teaching quality will be greatly reduced.

IV. Solutions to Problems in Modern Information Technology

1. *Rational use of Modern Information Technology, Pay Attention to the Main Role of Students*

There is no doubt that the application of modern information technology in mathematics teaching process can fully mobilize the enthusiasm of students, optimize the structure of the curriculum and other advantages, which can't be replaced by other technical means. However, it is only a tool to assist teaching, a new teaching mode. When using modern information technology in teaching, we should not only consider the content of teaching, but also pay attention to the characteristics and limitations of modern information technology. Therefore, when teachers use modern information technology in teaching, they can reasonably apply it in the following aspects and attach importance to the subject status of students in the learning process.

A. *Use of Micro Class Helps Students Preview Knowledge before Class, Break through the Key and Difficult Points after Class*

Micro class is a short, concise and well-known teaching tool, which has the advantages of short time consumption, prominent focus, small capacity and can be played in a loop, making it very suitable for use in teaching [4]. The key and difficult points of pre-class preparation and post-class breakthrough are important links in the learning process of students, and they are also easy to ignore. Most students have no direction in pre-class preparation without the guidance of teachers, so they cannot independently overcome the difficult points after class, which may easily lead to the accumulation of mathematical problems. Therefore, teachers can make a learning goal or explain a knowledge point in a 5-10 minutes' micro lesson to help students preview and break through the difficult math points. Students can adjust the speed of the video or choose to play it repeatedly according to their learning ability, which can improve the teaching quality.

Taking "geometric sequence" as an example, teachers should formulate teaching objectives when making micro-class hours before class: (i) Understand the concept of geometric sequence, master its general term formula and its derivation; (ii) Use the general term formula of geometric sequence to solve related problems; (iii) Master the definition of the middle term of the geometric sequence and be able to calculate it. Finally, let the students think independently to complete a simple geometric sequence of inquiry and test the effect of preview. The key and difficult points should be clarified in making micro-class after class. The difficult point is to master the general term formula of geometric sequence and use the formula to solve relevant problems. The difficult point is to use skillfully the geometric sequence summation method: (i) Dislocation phase subtraction; (ii) Cumulative addition; (iii) Substitution method; (iv) Undetermined coefficient method. Students can't flexibly use the method of geometric sequence summation. Therefore, when making micro-class, teachers can explain a method as an example so as to help students understand the sum formula of geometric sequence. As a result, students may break through the key and difficult points after class and avoid the accumulation of mathematical problems caused by the difficult points.

B. *Use Multimedia Technology to Improve Teaching Quality*

(1) *Create a Problem Situation, Stimulate Students' Interest, and Introduce a New Lesson*

In the process of teaching, it can be found that students of this age group cannot keep their attention on one thing for a long time. When introducing a new lesson, teachers need to use multimedia technology to set the problem situation reasonably and stimulate students' interest in learning this lesson. Because students are interested in the content, passive learning will be changed into active learning, thus improve the quality of teaching.

Take the "geometric sequence" as an example, when teaching a new lesson, teachers can use multimedia technology to set such a situation: dynamic cell division chart.

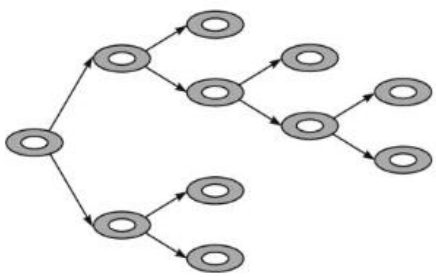

Fig. 1.

Teacher: A cell divides once into two, twice into four, and three times into eight. If it is split six times, how many cells do you get? What is the regular pattern of cell division? Write the number of cells after each division as a sequence. Can you write that sequence?

Student: Observe the dynamic chart, think and discuss to find out the rules of cell division, and record the number of cells obtained at each division, so as to get an infinite sequence of 1, 2, 4, 8...

Teacher: Lead the students to compare the concept of arithmetic sequence and explore the concept of geometric sequence, so as to introduce the new lesson. The introduction of new courses with multimedia technology can help students find new concerns, highlight the subject status of students, and let them consciously participate in the teaching, so that the teaching quality is naturally improved.

(2) *Increase the Practice Density, Improve the Teaching Effectiveness*

In traditional teaching, classroom practice is often ignored due to time limit, and the practice process lacks the guidance of the teacher, which makes it easy for students to understand the concepts, but fail to use the formula to solve the problem. Using multimedia to consolidate the practice can save the time of writing on the board and wiping, provide a large number of exercises in a short time, increase the density of practice, and improve the teaching effectiveness. And the multimedia courseware may include a variety of test models, break through the key points step by step with omni-directional, multi-angle, multi-level.

Take "geometric sequence" as an example, teachers can set multiple-choice questions, fill in the blanks and solve the calculation questions.

(i) Given that the Common Ratio of the Geometric Sequence is Positive, $a_3 \times a_9 = 2a_5^2$, $a_2 = 1$, $a_1 =$ （）

A. $\frac{1}{2}$ B. $\frac{\sqrt{2}}{2}$ C. $\sqrt{2}$ D. 2

(ii) The Sum of the First terms of the Sequence $\{a_n\}$ is S_n, if $a_1 = 1$, $a_{n+1} = 3S_n$ $(n \geq 1)$, then $a_6 =$ ( )

A. 3×4^4 B. $3 \times 4^4 + 1$ C. 4^4D.$4^4 + 1$

(iii) Set the common ratio $q = \frac{1}{2}$ of geometric sequence, the sum of the preceding n items is S_n, then $\frac{S_4}{a_4} =$.

(iv) We know what the geometric sequence is $\{a_n\}$, $common\ ratio\ q = \frac{1}{3}$, $a_1 = \frac{1}{3}$. S_n is the sum of the first terms of n, proving: $S_n = \frac{1-a_n}{2}$

We should pay attention to the differences between students and teach them in accordance with their aptitude. The difficulty of the exercise should be progressive, not too difficult or too simple. We should help students use flexibly the formula, grasp the key points and break through the difficult points. When the students answer correctly, the animation of "you are great, applause to encourage" can appear on the multimedia, which can enhance the students' confidence and arouse their enthusiasm to answer questions. When the students answer wrongly, the multimedia can appear "don't lose heart, try again" animation, so that students do not feel embarrassed. This design is also in line with the high-school students' competitive personality, animation can also enhance the fun of the classroom, boring practice will be interesting.

Fig. 2.

Fig. 3.

Fig. 4.

(3) *Integrate Knowledge Content to Help Students Build a Complete Knowledge System*

The knowledge content of high school textbooks is relatively complex, and there are many knowledge points in the teaching process, which may cause students to form chaotic mathematical thinking in the learning process and hinder them to form good mathematical thinking and learning habits [5]. Aimed at this situation, teachers can use multimedia technology integrated mathematics knowledge content, set up a mind map to help students organize related knowledge, improve the mathematics knowledge system. In this way, they can form a fluent mathematical thinking when they learn and consolidate knowledge points after class, and develop the learning habits of being willing to organize knowledge and good at drawing a mind map.

Taking “geometric sequence” as an example, teachers can use multimedia technology to build mind maps:

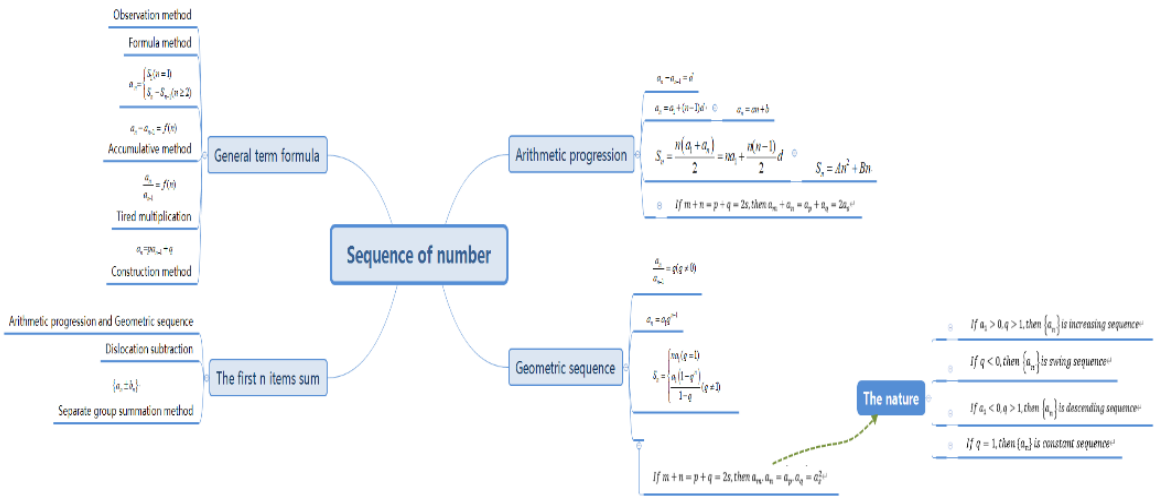

Fig. 5.

Geometric sequence is the learning point after students have learned arithmetic progression, both of which have something in common. Teachers can use multimedia technology to establish a framework of knowledge, help students to compare the content of two knowledge points. The establishment of a knowledge framework in the form of comparison can make students experience the differences and connection between two knowledge points more intuitively, which is beneficial to integrate the “geometric sequence” into the students’ existing knowledge system, and to establish a more complete and three-dimensional knowledge system, so as to improve the teaching quality.

(4) *With the Help of the Geometric Drawing Board, Students are Trained to Combine Mathematical thinking with Number and Shape*

With the development of modern information technology, geometry drawing board has become a new drawing software and teaching AIDS, and has been widely used in the teaching process especially in the teaching of solid geometry and functions [6]. In the teaching of solid geometry, for example, we can use "geometry drawing board" and multimedia display function to show rich solid geometry from various angles and different levels. Also we can continue the transformation of different point location of solid geometry, let students observe changes of three-dimensional geometry, do dynamic demonstration to students, help them to recognize and understand the changes of three-dimensional geometry, establish the concepts of space, the core of cultivating students' intuitive imagination accomplishment. It can also make the image of function more vivid and intuitive, and through the image to help students to establish the combination of mathematical thinking.

When having a new lesson of the image of y = cos (x + φ), teachers can use the drawing function of "geometry sketchpad" to make different image of φ before class. The change of contrast image clearly shows that + $\frac{\pi}{3}$ is to move $\frac{\pi}{3}$ unit to the left, and - $\frac{\pi}{3}$ is to move $\frac{\pi}{3}$ unit to the right. So we get the property: left plus right minus.

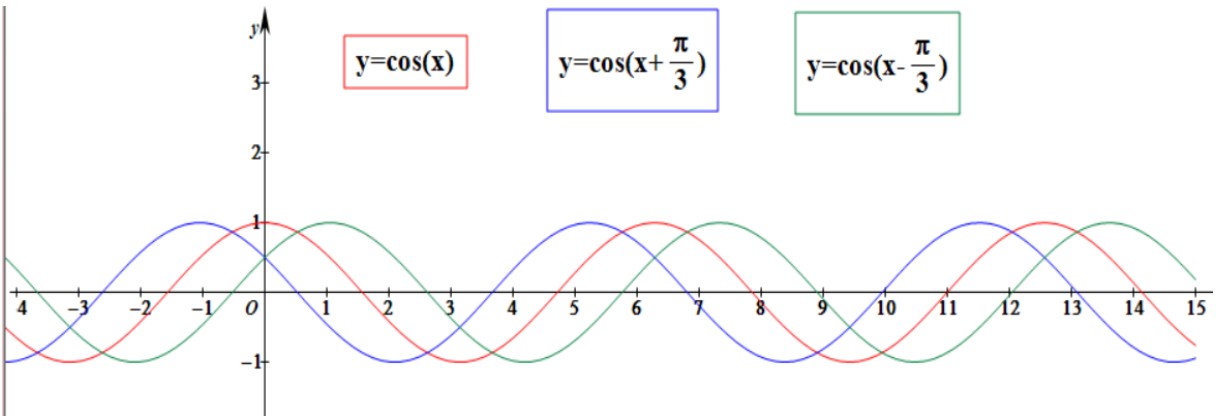

Fig. 6.

The purpose of this method is to enable students to observe the changing process of images more clearly and visualize the abstract knowledge. It can also save the time of drawing pictures on the blackboard. Teachers can use the saved time to let students draw pictures actively and get the corresponding mathematical properties, so as to improve students' ability of hands-on operation and independent thinking. Such a teaching process can make full use of the teaching time to optimize the classroom structure and cultivate students' mathematical thinking of combining number and shape.

2. *Combine Traditional Teaching Mode, Avoid Courseware Making Fancy*

Modern information technology cannot be replaced by the advantages of traditional teaching mode, such as teachers' reasonable writing on the board, intuitive teaching AIDS display, oral language and body voice expression, interaction between teachers and students, and adjusting teaching methods according to students' immediate feedback. When teachers are making courseware, traditional teaching mode should be combined. Pictures can be added appropriately to stimulate students' interest in learning and highlight the content of teaching materials. Fancy pictures and videos should not be allowed to distract students, so as to avoid the occu-

-rrence of the opposite situation [6].

Taking “geometric sequence” as an example, teachers can use multimedia technology to display dynamic diagram of cell division to create problem situation, attract students' interest, and introduce new lessons. They can also construct mind maps to help students build a complete knowledge framework. However, in the teaching process, each page of courseware should not contain a picture, and important knowledge points should be left on the blackboard, such as the definition of geometric sequence and the general term formula of geometric sequence, to help students build the knowledge system. The modern information technology and the traditional teaching mode are not antagonistic, but both are indispensable. In the teaching process, teachers should combine the advantages of traditional teaching and use flexibly modern information technology to improve the teaching quality effectively.

3. *Change the Concept of Modern Information Technology and Strengthen the Theoretical Study*

When applying modern information technology in mathematics classroom, teachers should change their backward concept of modern information technology and clarify the position of modern information technology in mathematics classroom teaching [7]. Systematic knowledge of modern education theory is the basis for teachers to use correctly modern information technology in teaching, and it is also the guidance of teachers in teaching activities. Teachers should strengthen the study of modern educational theory, improve the ability of making multimedia courseware, so as to serve well the mathematics classroom teaching. In the application of modern information technology in the teaching process, the teacher must distinguish the primary and secondary, clear the basic needs of education. At the same time, schools need to train teachers regularly in modern information technology, strengthen theoretical learning, test and evaluate them, and test teachers' ability in modern information technology, so as to ensure that teachers' ability in modern information technology can meet the needs of mathematics teaching. In the teacher team, we should exchange experience with each other, especially according to the needs of teaching content and pool wisdom, draw on each other's strengths, share resources, give play to everyone's advantages, learn from each other, and try to explore a better teaching mode that is more suitable for students.

V. CONCLUSION

With the development of science and technology, the level of modern information technology is also improving day by day. In the field of mathematics education, modern information technology is the only way to the reform and development of high school mathematics, and it has become an indispensable and important auxiliary tool for mathematics teachers in teaching activities. Only by applying flexibly modern information technology to the teaching reform can we improve the teaching quality and optimize the teaching structure. Schools should increase the training and practical research on modern information technology, apply rationally modern information technology in teaching activities, integrate the traditional teaching mode of mathematics classroom with modern educational technology, replace the original boring and boring classroom teaching environment, and visualize and live abstract mathematical knowledge. While seeking out the best combination of modern information technology and mathematics, mathematics teachers should also avoid the above mistakes, give full play to the role of modern information technology, create a good learning environment, in order to adapt to the reform and development of high school teaching.

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