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Research on Improving the Effectiveness of Mathematics Classroom Teaching in Senior High School by using Information Technology

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Abstract **– The 21st century is an information age. The rapid development of information technology provides an important opportunity for our education and teaching reform. Therefore, the application of information technology to education and teaching has become an inevitable trend of reform. As a dull subject in all disciplines, mathematics curriculum reform is of great urgency. Under the background of education informatization and new curriculum reform, this paper conducts a questionnaire survey and interviews with teachers and students of No. 2 Middle School in Yanji City, puts forward the role of the application of information technology in improving the effectiveness of classroom teaching in senior high school, and puts forward the strategies of using information technology to improve the effectiveness of mathematics classroom teaching in senior high school: using information technology to reform the teaching method ; using information technology to create effective problem situation; using information technology to overcome teaching difficulties.**

Keywords **– Information Technology, Senior High School Mathematics, Classroom Teaching, Effectiveness.**

I. INTRODUCTION

As early as October 2000, China had clearly pointed out that it would popularize information technology in the national education system in the future by convening a national conference. General Senior High School Mathematics Curriculum Standard (2017 Edition) further clarified that the senior high school mathematics curriculum should advocate the organic integration of information technology and curriculum content, use information technology to present the curriculum content which is difficult to present in the past teaching, and use scientific calculators and various mathematical education technology platforms as far as possible to strengthen the combination of mathematics teaching and information technology on the premise of guaranteeing the training of written arithmetic [1]. Therefore, education reform further requires senior high school mathematics teachers to combine information technology with mathematics disciplines, give full play to the unique functions of computers and assist teaching design, so as to make the classroom manifestations diversified and visualized, which is conducive to deepening students' understanding of the formation and development of mathematical concepts, and improve the effectiveness of senior high school mathematics classroom teaching.

II. CONCEPT DEFINITION

A. *Information Technology*

Different scholars have different understandings on the definition and connotation of information technology. Professor Nan believes that information technology is an intelligent form of technology, as well as a physical form of collecting, processing, storing, exchanging and applying information. Professor Huang thinks that information technology is a kind of technology that can complete the functions of information acquisition, transmission, processing, regeneration and application.

B. *Effectiveness of Classroom Teaching*

"Effectiveness of classroom teaching" is actually a noun expression of "effective classroom teaching". There is no big difference between the two meanings. Professor Song thinks that "the effectiveness of classroom teaching is that teachers and students follow the objective law of teaching activities to promote students' sustainable progress and development in knowledge and skills, processes and methods, emotional attitudes and values with the best speed and efficiency, so as to achieve the expected teaching objectives and meet the needs of society and individuals." Therefore, I believe that the effectiveness of classroom teaching is mainly reflected in paying attention to the progress and development of students [2].

III. THE ROLE OF THE APPLICATION OF INFORMATION TECHNOLOGY IN IMPROVING THE EFFECTIVENESS OF MATHEMATICS CLASSROOM TEACHING IN SENIOR HIGH SCHOOL

A. *The Student Part*

In this study, 50 students from Class 1, Senior Two and 50 students from Class 2, Senior Two of Yanji No. 2 Middle School in Jilin Province were taken as the research objects. At the beginning of a semester, for the same teaching content, I applied information technology teaching method to class 1(as experimental class) and traditional classroom teaching method to class 2 (as control class). After a period of teaching, questionnaire survey was adopted to understand the role of information technology teaching in improving the effectiveness of senior high school mathematics classroom teaching, and the effectiveness of classroom teaching will be analyzed from the two aspects of "students' mathematics learning situation" and "students' mathematics learning achievements".

1. *Comparisons in Students' Mathematics Learning Situation*

Through the questionnaire survey of experimental class students, to explore the use of information technology teaching on the impact of students' mathematics learning situation. 50 questionnaires were sent out and 50 were recovered. There are a total of 9 questions in the questionnaire, which are answered by students according to their own situation. The answers are divided into four categories: A, B, C and D, and then the corresponding percentages are calculated, as shown in the following table **I**.

Table I. Comparisons of Mathematics Learning Situation before and after the of Information Technology in the Experimental Class.

Investigation item	Option	Pre-experiment	Post-experiment
1.Your attitude to mathematics	A. Very interested	4（8%）	15（30%）
	B. Interested	15（30%）	19（38%）
	C. General	23（46%）	13（26%）
	D. Not interested	8（16%）	3（6%）
2. When you study math now, you often do	A. Very active	10（20%）	20（40%）
	B. A little initiative	16（32%）	23（46%）
	C. More passive	19（38%）	6（12%）
	D. Very passive	5（10%）	1（2%）
3. Now you often pay attention to it in math class	A. Imitating, memorizing and dealing with an exam	18（36%）	12（24%）
	B. Just listen to the teacher	15（30%）	10（20%）
	C. Do a lot of exercises	10（20%）	6（12%）

Investigation item	Option	Pre-experiment	Post-experiment
	D. Active observation, conjecture, verification and practice	7（14%）	22（14%）
4. Do you like mathematical inquiry activities like "hands-on practice, observation, conjecture, verification"	A. Very much	15（30%）	25（50%）
	B. General	20（40%）	18（36%）
	C. Not really	10（20%）	5（10%）
	D. Very disliked	5（10%）	2（4%）
5. You think that mathematical inquiry activities will help you learn the basic knowledge of mathematics	A. Very bad	6（12%）	2（4%）
	B. Not very helpful	18（36%）	5（10%）
	C. General	18（36%）	13（26%）
	D. Very helpful	8（16%）	30（60%）
6. In the current mathematics textbook study, you take the initiative to ask questions	A. Hardly any	14（28%）	3（6%）
	B. Not really	14（28%）	6（12%）
	C. Sometimes	18（36%）	25（50%）
	D. Often	4（8%）	16（32%）
7. In mathematics learning, you communicate with teachers and classmates	A. Often actively	14（28%）	25（50%）
	B. More actively	18（36%）	15（30%）
	C. More passively	12（24%）	7（14%）
	D. Very passively	6（12 %）	3（6%）
8. In doing math problems, you usually do	A. Just do it in one way	28（56%）	15（30%）
	B. If you can't do it, don't do it	10（20%）	5（10%）
	C. Often use a variety of ways to think about a question	4（8%）	12（24%）
	D. Sometimes find more than one solution to a problem	8（16%）	18（36%）
9. Do you think you can learn math well through the current method of learning math	A. Very confident	10（20%）	19（38%）
	B. Basically no problem	15（30%）	18（36%）
	C. Feeling a little difficult	15（30%）	8（16%）
	D. Almost uncertain	10（20%）	5（10%）

The data in the table **I** show that after using information technology to teach, the number of students interested in mathematics learning has increased from 38% before using to 68% after using; At present, 86% of the students show that they like or prefer mathematics inquiry teaching activities, and feel that mathematics inquiry activities are beneficial to students' learning of basic mathematics knowledge [3]; Students who communicate with teachers and classmates also increased from 64% to 80%; 74% of students show that using information technology to teach is more conducive to learning mathematics. Therefore, it can be seen that the use of information technology in teaching can enable students to actively participate in the learning process, change their emotional attitudes in mathematics learning, strengthen students' ability to ask, find and solve problems, and also cultivate students' sense of teamwork and cooperation, so as to truly achieve effective senior high school mathematics classroom teaching.

2. *Comparisons in Students' Mathematics Learning Achievements*

In order to study the influence of information technology teaching on students' learning achievements, the average scores of students in the experimental class are compared with those in the control class at the top, middle

and low levels. The results are as follows.

Table II. Comparisons of Mathematics Learning Achievements of Students at three Levels in the Experimental Class and the Control Class.

Level	Group	Number	Pre-test (entrance achievement)	Mid-test (at the end of the first semester)	Post-test (at the end of the second semester)
Top students	Experimental class	15	89.50	87.20	90.45
	Control class	15	89.70	86.40	87.60
Middle students	Experimental class	25	76.90	75.60	78.45
	Control class	25	76.50	74.90	75.30
Underachievers	Experimental class	10	62.50	60.25	63.70
	Control class	10	62.75	60.10	62.80

According to the data in the table **II**, there is no significant difference between the average scores of students at the three levels in experimental class and control class upon enrollment; In the middle test, the average scores of students in the two classes at three levels begin to show a little difference, mainly reflected in the top students and middle students; In the post-test, the difference in average scores between the two classes is more obvious. Comparing the experimental class with the control class, the average scores of the top students are 2.85 points higher than the latter, the average scores of the middle students are 3.15 points higher than the latter, and the average scores of underachievers are 0.9 points higher than the latter. Therefore, the use of information technology teaching can promote students' mathematics achievements. Through the comparison of the above experiments, it can be clearly seen that the introduction of information technology into senior high school mathematics classroom will slowly change students' learning attitude, stimulate students' interest in learning, help to improve students' innovative consciousness and self-awareness, fully reflecting that the use of information technology can improve effectiveness of senior high school mathematics classroom teaching [4].

B. *The Teacher Part*

In this study, 24 math teachers from different grades of Yanji No. 2 Middle School in Jilin Province were randomly selected by interview method. According to the interview outline, I communicated with teachers to understand teachers' attitudes towards using information technology to improve the effectiveness of classroom teaching in senior high school. After the interview, it was found that almost all mathematics teachers believed that information technology could improve teachers' teaching ability (mainly teachers' teaching design ability and teachers' teaching resources development ability), so they took a positive attitude to using information technology to improve the effectiveness of classroom teaching in senior high school.

1. *Favorable to the Improvement of Teachers' Teaching Design Ability*

Among the teachers interviewed, 17 believed that the use of information technology could improve teachers' teaching design ability. I select two representative interview records, which are as follows:

Question: "What role do you think the use of information technology plays in improving the effectiveness of classroom teaching?"

T1: "... In order to design a lesson well, teaching design is of the utmost importance. Schools stipulate that collective lesson preparation should be organized once a week, but due to the short time of concentration, it often

fails to achieve the desired results. Therefore, we have set up QQ group and share the good instructional design on the network, which greatly improves the efficiency of lesson preparation... "

T2: "... Sometimes I find good instructional designs on the Internet and share them with my colleagues by QQ. When I see good articles in magazines, I shoot them on my mobile phone and upload them on Baidu Cloud... "

From the interview records, we can see that the use of information technology (e.g. WeChat, twitter, QQ, personal website, etc.) can help teachers better complete the teaching design. Whether it is studying textbooks or teaching methods, or even through communication with students to grasp the learning situation of students.

2. *Favorable to the Improvement of Teachers' Teaching Resources Development Ability*

Among the teachers interviewed, 15 mentioned that the use of information technology can improve teachers' ability to develop teaching resources. I select two representative teachers' answers as follows:

Question: "What role do you think the use of information technology plays in improving the effectiveness of classroom teaching?"

T3: "... In the past, teaching resources mainly consisted of teaching aids and reference books. With the development of information technology, the types of teaching resources have been increased. At present, I have mastered the method of making geometric sketchpad, but I know there are many skills that need to be further studied... "

T4: "... Using the Internet, we can get all kinds of teaching resources, and using these resources in the classroom will let students know that senior high school mathematics is full of charm and fun, not as boring as they thought."

From the interview records, we can see that classroom teaching can not be separated from the support of abundant classroom teaching resources. Through information technology, it can increase the types of senior high school mathematics classroom teaching resources (such as presentation, interactive courseware, geometric sketchpad, etc.), optimize classroom teaching methods, improve classroom teaching environment, and ultimately improve the effectiveness of senior high school mathematics classroom teaching [5].

IV. Strategies for Improving the Effectiveness of Mathematics Classroom Teaching in Senior High School by using Information Technology

A. *Using Information Technology to reform teaching methods, Fully Embodying the Subjectivity of Students' Learning*

In the past, the teaching mode of mathematics in senior high school was basically teacher-centered, and students were in a passive position. Information technology has a powerful function of information search and storage. If it is introduced into mathematics classroom, students can rely on their own abilities and use information technology to explore and analyze mathematics knowledge independently, they can become the masters of classroom learning activities.

For example, in learning ‘the structure of space geometry’, before class, teachers can group the students in the class and ask each group to use modern information technology to collect information related to the content of this section, such as prism, pyramid, trustum of a pyramid, sphere of space physical graphics, as well as their structural characteristics. In class, each group exchanges information based on the survey, and the teacher makes

a final evaluation. In this way, by letting students explore new knowledge of mathematics using modern information technology in groups, on the one hand, it fully embodies the subjectivity of students' learning, on the other hand, it makes students familiar with and understand the content of this section in advance. In formal learning, it is helpful to deepen students' understanding of mathematical knowledge, so as to lay a solid foundation for the effective teaching of senior high school mathematics.

B. *Using Information Technology to create Effective Problem Situations and Stimulating Students' desire to Explore*

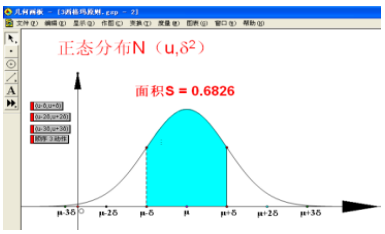
Senior high school students, thinking more active, dare to put forward different opinions. Therefore, in mathematics classroom, especially in the introduction of new courses, teachers can use information technology to create good problem situations for students, so that students can open the gates of thinking, and students' learning state of new knowledge of mathematics from passive to active [6].

For example, when learning the concept of 'monotony of function', we can use information technology to present the temperature change map of a certain day in the city where the students live and K-line chart of the stock market, and then put forward the real problems related to the students' life experience. In this way, it stimulates students' desire to explore new knowledge, and provides sufficient guarantee for the effectiveness of senior high school mathematics classroom teaching.

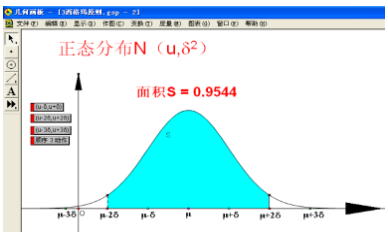
C. *Using Information Technology to break through the difficulties of Teaching and reducing the difficulty of Students' Understanding*

Mathematics is a subject that studies the relationship between spatial form and quantity. Many knowledge points in textbooks rely solely on the oral explanation of teachers, which makes it difficult for students to understand effectively. Information technology has the characteristics of abstract into concrete and static into dynamic. If it is introduced into senior high school mathematics classroom, it can successfully break through the difficulties of mathematics teaching, thus reducing the difficulty of students' understanding and maximizing the benefits of senior high school mathematics classroom.

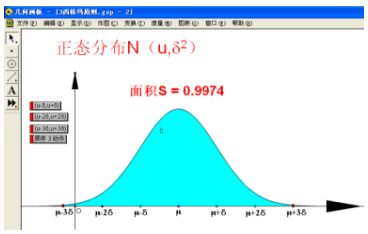
For example, in learning the section 'Normal Distribution', as for '3σ principle', if the teachers instill the conclusion directly into the students, the students may not really understand the meaning of the image, but memorize the knowledge points by rote. At this time, teachers can introduce the geometric sketchpad into the teaching classroom, use the functions of information technology, such as rapid development and slow down, and watch the image of the '3σ principle' repeatedly (as shown below), so as to help students overcome this learning difficulty and make students understand these knowledge points in depth, so as to achieve the effectiveness of senior high school mathematics teaching to create favorable conditions [7].



$P(\mu-\sigma<X\le\mu+\sigma)=0.6826$



$P(\mu-2\sigma<X\le\mu+2\sigma)=0.9544$



$P(\mu-3\sigma<X\le\mu+3\sigma)=0.9974$

V. CONCLUSION

Under the background of education informationization and new curriculum reform, the integration of information technology and senior high school mathematics curriculum will inevitably affect the effectiveness of classroom teaching. The application of information technology in teaching can make the dull and tedious teaching process more interesting, make the obscure and difficult mathematics knowledge more simple and vivid, and make students enjoy learning mathematics and good at learning mathematics. To a certain extent, I have systematically discussed how to use information technology to improve the effectiveness of senior high school classroom teaching. However, due to its limited level, it is impossible to conduct more in-depth investigation and research. Therefore, mathematics teachers should make great efforts to explore the measures and ways of applying information technology to mathematics teaching, so that the effectiveness of senior high school mathematics classroom teaching can be maximally developed and improved with the support of information technology environment.

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