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The Application of Research Learning into Mathematics Classroom Teaching

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Abstract **– Research-based learning is newly established in 2000. It advocates for students' independence in exploring, learning, selecting and determining solutions, and developing students' practical ability. It has become a hot spot in today's classroom teaching. Besides, if teachers apply research-based learning in teaching and leading students to research, a better outcome will come out. The application of research-based learning is also in favor to students' overall development. I have studied on the necessity and feasibility of applying research-based learning in teaching maths, from concept, background, evolution process, teaching mode and social practice. The research result proves that research-based learning helps students learn knowledge and skills positively, applying what they learn in practice and solve practical problems, develop interest in learning, and moreover be ready for future after graduation.**

Keywords **– Research-Based Learning, Mathematics Classroom Teaching, Teaching Mode.**

I. Background and Evolution of Research-Based Learning

A. *Background*

The early education reform in China led to the application of research-based learning in primary schools, but research-based learning dates back to long before and it has been applied for a long time in France, the United States, and Japan. It is because research-based learning is a way which can adapt to various changes in society and can help solve problems. Its features leads to different ideas, methods and outcomes, and are helpful for students' subjective initiative, autonomy, consciousness and creativity [1].

Talent is the symbol of national strength, but the school teaching at present is not good for talent training. Usually, teachers are autocratic instead of democratic. Thus students are inactive in both learning knowledge and communicating with teachers. In the face of this situation, the first thing is to change education concept and teaching methods, and then improve teaching efficiency. Therefore, research-based learning should be introduced and widely applied in mathematics classroom teaching in China to adapt education reform.

B. *Evolution*

Research-based learning has been promoted many times since ancient times, and as far as I know there are three times. The first promotion was by Rousseau and Pestalozzi. Rousseau put forward the idea of nature education. He put forward the idea of nature and free education in his educational masterpiece "Love Deaf." the second promotion was by Dewey, Kebo, and others [2].

Research-based learning has been promoted many times since ancient times, and as far as I know it has been three times. The first was initiated by Rousseau and Pestalozzi. Rousseau put forward the idea of nature education. He put forward the idea of nature and free education in his educational masterpiece "Love Deaf." The second time was advocated by Dewey, Kebo, and others. He believes that education is a way of life, not a preparation for future. What has been advocated during this period is the era of democratization and industrialization of society [3]. Its purpose is to cultivate talents capable of adapting to this ever-changing world, talents capable of changing

nature and being able to change society. The third promotion was advocated by Bruner and others. Bruner proposed the "Structural Curriculum Theory" for education. He advocates that the primary thing in learning a subject is to learn its structure, principles, and concepts. He believes that all the basic concepts have the same effect. Bruner uses discovery as a teaching method. He believes that any subject knowledge is a kind of structure. The knowledge structure itself has the effect of rational development and the purpose of education is to develop students' intelligence and cultivate their excellence!

II. THE CONCEPT OF RESEARCH-BASED LEARNING AND ITS TEACHING CHARACTERISTICS

The concept of research-based learning has not reached a unified opinion in the field of education, and there is no clear regulation. By the same token, the perception of the concept of research-based learning varies from country to country [4]. Some recognize research-based learning as a form of learning, and also consider it as the type of learning curriculum, and also consider it as an organizational form of teaching.

The teaching characteristics of research-based learning are as follows:

A. *Autonomy*

To make students more adept at discovering problems in life and learning and solving them. This is relatively independent of the authoritarian approach to teaching. He asked the students to study and experience in person. Making performance is more important than the outcome.

B. *Practical*

Practicalness advocates students to experience the learning process themselves and get more experience. Students' self-confidence can be enhanced in the process of continuous research, and they can think from all aspects, propose the analysis and case development to the implementation and operation of the case.

C. *Openness*

It can cultivate students' attitude towards learning and treating life, and can cultivate students' innovative spirit and ability to research and explore. The content of research-based learning is also very open. Research-based learning can be applied in many subjects, and not only in learning, but also in life.

D. *Processability*

Research-based learning is a procedural application research. We will experience many problems in the process of learning and encounter many difficulties. Students can enhance their will and indomitable spirit through research-based learning [5]. What is important is not the result of learning, but the process of learning and the experience and growth gained in the process of research-based learning.

III. TEACHING THEORY OF APPLYING RESEARCH-BASED LEARNING IN MATHEMATICS CLASSROOM TEACHING

Applying research-based learning as a compulsory course in primary and secondary schools is not only because of social needs, but also because it has a deep and unquestionable theoretical basis.

A. *Theoretical basis of Applying Research-Based Learning in Mathematics Classroom Teaching*

1. *Behaviorism*

The behavior-contact theory of learning believes that all learning is a process of establishing direct contact between stimulus S and stimulus R through conditional effects. Behaviorism believes that learning is influenced by environmental stimuli. Skinner is a famous behaviorist psychologist. According to Skinner's behaviorism theory, teachers should first help students to determine or guide students to determine the teaching objectives, and then ask questions to let students discuss themselves. This kind of inquiry learning can increase students' interest and hobbies in learning, improve the quality of learning from a larger perspective, and improve the teaching quality of teachers.

2. *Cognitivism*

Cognitive teaching theory was proposed by Bruner. Bruner made a detailed analysis of the structure theory with his own unique insights. He has made a great contribution to education. According to Bruner's cognitive theory, students can understand the basic structure of the subject, and it is easy to grasp the knowledge of the whole subject, which can promote the transfer of learning, promote the development of students' intelligence and creativity, and enhance the interest of learning.

3. *Constructivism*

According to constructivism, teachers should not only present knowledge, but pay more attention to students' understanding of various phenomena, listen to their ideas, and use this as a basis to guide students to enrich or adjust their understanding.

B. *Analysis on Elements of Applying Research-Based Learning in Mathematics Classroom Teaching*

The above series of theories can be concluded that the whole and the part are mutually restrained. When applying research-based learning in the mathematics classroom teaching, it is necessary to analyze the elements of each detail.

1. *Learning Content*

The mathematical knowledge of broadcasting is composed of mathematical concepts related to mathematical propositions, methods of learning mathematics and knowledge of mathematical history, and the content we have studied has also had a great impact on research learning.

2. *Students' Role in Research-based Learning*

In education and teaching, students, the main body of learning, have also played an influential role in mathematics teaching methods. The method, progress, and results are determined by the students themselves. In this way, the student is both a designer and an implementer, a proponent and an organizer. It clearly reflects the main position of students in the learning process.

3. *The Role of the Teachers in Research-based Learning*

Teachers should preaching, receive and dissolve doubts. A qualified teacher is not only teach the traditional book knowledge, but also educate, teach learning methods, and develop students' interest in learning. Teachers are the promoters of student growth, friends of students, designers, organizers and managers in teaching activities.

In the process of research-based learning, students and teachers jointly explore and jointly study the educational management concept of democracy, and cultivate students' ability of interpersonal communication and harmonious coexistence, so that they can understand world outlook on science, outlook on life and values from the process of research-based learning [6].

IV. Teaching Mode of Applying Research-based Learning in Mathematics Classroom Teaching

Teaching mode can be defined as a teaching activity, structure, framework and activity program established under the guidance of certain teaching ideas and teaching theories. This kind of teaching activity is relatively stable and reliable. It is more conducive to teachers to teach, so that teachers can achieve a very high level of teaching in every class! The teaching model can embody the teaching objectives and is a reflection of the method practice. Students applying research-based learning can improve students' subjective initiative, improve students' practical ability, ability to collaborate and cooperate with others, interpersonal skills, and improve the quality of teachers' teaching. The specific steps are the creation of situational problems, the joint discussion between teachers and students in an equal way, the discussion of students to solve problems autonomously, and the self-evaluation of students.

A. *Teaching Objectives of Applying Research-based Learning in Mathematics Classroom Teaching*

The educational teleology introduced by Bruner's three-dimensional theory can be seen as: cognitive, emotional, and motor skills. Then, the author will elaborate on the above three areas.

1. *Teaching Objectives in the Cognitive Field*

The cognitive domain can be divided into six levels: knowing, understanding, applying, analyzing, synthesizing, and evaluating. Knowing is to know and remember. This level refers to the identification of specific knowledge, which is specific knowledge, such as: some mathematical principles, mathematical properties, etc. Comprehension refers to the understanding of things, does not mean how profoundly high-level understanding, often is a superficial basis. Analysis refers to the step-by-step analysis of the various elements and details of all the objects analyzed, the detailed description, its principle, nature and so on. This author does not elaborate on this.

2. *Teaching Objectives in Emotional Emotions*

The interest of students in learning, the attitude towards learning, and the emotions of students during group discussions are all manifestations of emotional emotions. The first step in the learning process is to first determine the teaching objectives. The cognitive goals can also lead to individual emotional goals, which can lead to the characteristics of students' personality emotions, attitudes towards learning and positive interests. In turn, these positive attitudes can promote the realization of teaching objectives. Therefore, the interaction between emotional emotions and teaching goals promotes each other. Therefore, students should be trained before they engage in research-based learning.

The following three objectives should be achieved: 1 objectives in interest and hobbies. Whether a student is interested in this subject determines her attitude towards learning and indirectly affects the quality of teaching. Therefore, this goal can make students more willing to get close to mathematics, enhance the "communication" with mathematics, and improve their learning outcomes. 2 objectives in will and self-confidence. Self-confidence

is indispensable in the learning process, and one's will can restrain the waywardness of students. This goal allows students to face the difficulties and bravely overcome his will and self-confidence, and strengthen the students' practical ability. 3 objectives in experience and feeling. If students can experience the logic and reasoning that mathematics brings to him in life, it will further enhance his interest and emotion in learning, and is more conducive to the realization of learning objectives. This goal allows students to experience the fun of mathematics and make students more close to mathematics. This goal can give students the interest in the constant exploration and pursuit of mathematics in life, and experience the rigor, logic and certainty of mathematics.

B. *Two Teaching Modes of Applying Research-based Learning in Mathematics Classroom Teaching*

1. *Problem Solving Mode*

This model was first proposed by Mahmutov. This model enhances the initiative of students to learn and changes the passive mode of student learning in the past. The subjective initiative of students is greatly improved. Teachers as observers guide organizers let students grow up, cultivate their own strengths, interests and hobbies, cultivate students' problem awareness, enable students to acquire more mathematics knowledge in practice, and cultivate students' emotional attitudes and values.

2. *Independent Research Mode*

The independent research model can be understood as the correct guidance of the teacher. The students can carry out independent exploration and research, ask questions, make assumptions, find solutions, research plans, and self-evaluation. This model has certain subjectivity, cooperation, independence and innovation. It is to fully reflect the subjectivity of students in the process of teaching in the process of teaching. Independent and independent learning can enable students to think independently, thus solving problems in learning, cultivating self-innovation, innovation and innovation.

C. *Basic Structure of Teaching Modes of Applying Research-based Learning in Mathematics Classroom Teaching*

In Piaget's constructivist theory, a teaching model is mentioned, which is the aiming teaching. This teaching is divided into five parts, which will be explained in detail below.

1. *Teachers Should Guide Students to Create Situations for Research Problems before Research-based Learning*

This is the starting point for research-based learning and the key to research-based learning. The mathematics we have learned is not only applied in books, but also applied to our life in the process of research-based learning. We should take advantage of the knowledge, skills and experience that are already in the student's mind. Leading students to create situations that play a key role in the student's learning process.

2. *Identify the Problem*

This process is a student's knowledge through the mind, identifying problems, and thinking independently. Use teaching tools to think and learn all aspects of the learning process. Teachers should motivate students to learn independently in the entire teaching activities.

3. *Independent Learning and Research-based Learning*

In the process of research-based learning, teachers should strive to make every student motivate and motivate each student to participate in the study. It is also necessary for the students to actively and actively learn under the guidance of the teacher. Let the students solve the problem proactively and draw their own conclusions. Under the guidance of the teacher, I get the correct conclusion.

V. Application of Research-Based Learning in Mathematics Classroom

In order to understand the application of research-based learning methods in high school mathematics classrooms, a total of 500 students in three grades of a high school in Yanji City were surveyed.

Table 5-1 Survey of students' preference for lectures.

Traditional Teaching Methods	Research Study	Self-Study
31.9%	61.2%	6.9%

From Table 5-1, we can see that 31.9% of the students are more inclined to the traditional way of teaching. In the process of understanding, most students who are not good at communicating with teachers and classmates tend to prefer this way. Receptive learning. 61.2% of the students like research-based teaching methods. These students are more willing to think positively and take the initiative to analyze mathematics problems. In the process of communicating with classmates, they gradually collide with the spark of thinking. There are also some students who like to complete their study tasks independently.

Table 5-2 Investigation of research application.

Survey Content	Options	High One (%)	High Two (%)	High Three (%)	Total (%)
1. Teacher's current teaching method	A. Traditional teaching	22.3	37.5	67.1	42.3
	B. Research learning	44.5	51.2	20.2	38.6
	C. Other	33.2	11.3	12.7	19.1
2. Do you know if research-based learning understands research-based learning?	A. Understanding	20.1	33.3	45.2	32.8
	B. Know a little	78.0	61.4	50.1	63.1
	C. Don't understand	1.9	5.3	4.7	4.1
3. Do you like teachers to use research learning?	A. Like very much	45.2	49.1	27.3	40.5
	B. A little like	36.5	32.4	36.8	35.2
	C. Dislike	18.3	18.5	35.9	24.3
4. Mathematics teachers use research-based learning in the past six months	A. 3 times or less	48.6	61.6	81.7	63.9
	B. 3-10 times	27.5	33.3	13.3	24.7
	C. More than 10 times	23.9	4.8	5.0	11.4
5. Other subject teachers use research-based learning	A. More	36.3	25.0	4.5	21.9
	B. Rarely	51.3	58.3	20.0	60.3
	C. No one	12.4	16.7	75.5	17.8
6. Does research-based learning improve mathematics interest?	A. Can	53.7	50.0	33.3	45.7
	B. Should be OK	28.7	28.3	35.6	30.8
	C. Almost no	17.6	21.7	31.1	23.5

From Table 3-2, we can see that the current high school mathematics teachers are mainly based on traditional teaching methods, especially in the third year of high school. It may be related to the pressure of preparing for the third year of high school. Teachers are more inclined to traditional methods and do not try to study learning. High school and high school students prefer the way of research-based learning and exchanges with teachers. Among them, 3-10 times in half a year account for about one-third, and the number of teachings in other disciplines is compared. More teachers also occupy about a third.

VI. CONCLUSION

The author has introduced the research-based learning into the mathematics classroom teaching, explored the application of research-based learning and through the actual case analysis, also achieved great results, and also reached many conclusions. In research-based learning, we must pay attention to the encouragement and guidance of the students, let the students personally try the experience, actively explore, enhance the students' sense of success, stimulate students' deep interest in learning, and let the students develop well. Good habit of loving learning.

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