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Research on Cultivating Students' "Four Abilities" by High School Mathematics Heuristic Teaching

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Abstract **– In high school mathematics teaching, heuristic teaching, as a new teaching method, can stimulate students' interest in learning mathematics, arouse students' initiative and enthusiasm for learning, inspire students to think, promote the effective formation and development of thinking, and can cultivate Students "four ability". Based on heuristic teaching, this paper studies the cultivation of students' "four abilities", which has certain positive significance for teachers to design and implement heuristic teaching in mathematics teaching.**

Keywords **– Heuristic Teaching, Ability to Find and Ask Questions, Ability to Analyze and Solve Problems.**

I. INTRODUCTION

On July 9, 2019, the Information Office of the State Council held a press conference on the "Opinions on deepening the reform of education and teaching and comprehensively improving the quality of compulsory education", mentioning the need to strengthen classroom reforms and clearly pointing out the need to innovate teaching methods and change purely full of duck-filling education, which mentions that heuristic teaching is one of the most efficient teaching modes. Professor Zhang Dianzhou, a well-known mathematics educator in China, believes that heuristic teaching is a tradition that teachers should always stick to when they speak, and it cannot be forgotten. Cao Caihan, the famous mathematics educator in China and the founder and founder of mathematics education psychology in China, also mentioned in "Mathematics Education Psychology": "The establishment of heuristic teaching ideas by mathematics teachers is the fundamental guarantee for the success of their teaching." The former Soviet Union's mathematics pedagogy expert BM Blaski believes that teachers should not directly teach ready-made knowledge to students, but should guide students to independently discover corresponding propositions and rules, such teaching methods become heuristics teaching method [1]. It is worth noting that in view of the current high school mathematics teaching in China, many high school mathematics teachers pay too much attention to the teaching of mathematics because of social, educational status, pressure of college entrance examination, and tense teaching tasks. "Full house irrigation" way, students' learning efficiency declines and seriously hinders students' ability to find and raise problems, analyze and solve problems from a mathematical perspective [2]. The 2017 edition of the "General high school mathematics curriculum standards" clearly stated in the course objectives: "Through the high school mathematics curriculum, students can improve their ability to find and raise problems from the perspective of mathematics, analyze and solve problems (referred to as "Four abilities")." From this we can see that our country attaches great importance to the cultivation of students' "four abilities", and heuristic teaching has irreplaceable educational value for students' "four abilities" [3]. Research is necessary. There are relatively few studies on the cultivation of students' "four abilities" in high school mathematics heuristic teaching. This study can enrich the research materials of high school mathematics heuristic teaching. At the same time, it puts forward suggestions for teachers to use heuristic teaching to train students in high school mathematics teaching. It can encourage teachers to attach importance to heuristic teaching, and hope to provide valuable experience and reference for

front-line teachers.

II. Connotation of Heuristic Teaching

A. *The Meaning of Heuristic Teaching*

Heuristic teaching refers to the teacher's teaching tasks and the objective laws of student learning in the teaching process, starting from the student's actual situation, using a variety of methods, with the inspiration of students' thinking as the core, mobilizing students' learning initiative and enthusiasm to promote them A teaching guiding ideology to learn vividly [4]. Heuristic teaching is a bilateral activity in which "teaching" and "learning" interact. First of all, it is emphasized that mathematics teachers must establish heuristic teaching ideas. Teachers' "teaching" is the key, which determines the effect of the entire teaching activity. Second, we must highlight the student's dominant position. The student's "learning" is the ultimate goal, and strive to promote the overall development of students. Heuristic teaching has a positive impact on students' mathematics learning. Combining the characteristics of students' knowledge structure and cognitive development laws, organizing meaningful and enlightening teaching activities, guiding students to carry out thinking activities, mobilizing students' enthusiasm for learning, harvesting knowledge, and training ability to achieve teaching goals and promote comprehensive development of students.

B. *Related Theoretical Basis*

The theoretical basis that can support high school mathematics heuristic teaching are: heuristic teaching theory and constructivist learning theory.

Heuristic teaching theory was first advocated by Confucius as early as in ancient times. Since then, Confucianism has always focused on heuristic teaching to inspire students to think actively and cultivate students' ability to learn independently. In the "Student's Records", "Gentleman" is also proposed. The teaching of Yu is also the same. The way is inferior, the strong is restrained, and the open is in Fuda. "Later, in the West also received a lot of support. The famous educator Socrates innovated the teaching method of" midwife "based on heuristic teaching. Heuristic teaching emphasizes on taking students as the main body of teaching, focusing on inspiring students, giving students enough room to learn, and promoting students' independent thinking and exploring knowledge. Heuristic teaching emphasizes the integrity of "teaching" and "learning". Teachers organize students to organize meaningful teaching activities to influence students' learning purposely, so that students can be inspired, gain knowledge, and improve their abilities. In summary, according to heuristic teaching theory, heuristic teaching should be used to stimulate students' desire to explore knowledge in high school mathematics teaching, and guide students to develop thinking, explore knowledge, and constantly think and explore, which provides a theoretical basis for the research.

Constructivism believes that learning is an act of actively and actively receiving various kinds of information. Learning is not only an activity of individual students, but also is realized in the interaction with others. It is a social activity, which is completely different from the traditional teaching concept, different. The constructivist view of students emphasizes that teaching should pay attention to the students' existing experience, starting from the students' existing knowledge structure and using it as a growth point for new knowledge to guide students to learn new knowledge from the original experience. Constructivist teaching view believes that teaching should guide students to carry out high-level thinking activities, and teachers should continue to guide students to carry

out thinking activities, students continue to think, and continue to process and transform various external information and concepts. Constructivism focuses on student-centeredness, emphasizes the initiative of students to learn, inspires students to think through heuristic teaching, and encourages students to explore boldly. In summary, according to the constructivist learning theory, in high school mathematics teaching, teachers should proceed from the students' existing knowledge structure and promote the formation and development of students' thinking through heuristic teaching, and promote students' independent construction of knowledge to provide the research theoretical support.

C. *The Role of Heuristic Teaching*

a. *Stimulate Learning Interest and Mobilize Learning Enthusiasm*

High school mathematics subjects are highly abstract, rigorous logic, coupled with the complexity of knowledge points, often make students feel monotonous and boring, resulting in some students' interest in learning mathematics declined. Einstein once said: "Interest is the best teacher." This is especially important for mathematics. Heuristic teaching can effectively arouse students 'interest in learning. Teachers create effective teaching situations through heuristic teaching, using the characteristics of students' strong curiosity, which can stimulate students 'curiosity, stimulate students' interest in learning, and arouse students. The enthusiasm and initiative of the mathematics adds a vivid atmosphere of mathematics classroom teaching.

b. *Inspire Students to Think and Promote thinking Development*

In the course of high school mathematics teaching, not only to teach students book knowledge, but more importantly, to train students' thinking formation and ability training. Heuristic teaching is different from the previous teaching methods. It enables students to change from passively accepting knowledge to active learning knowledge. It fully reflects the student's subjective status and exerts the student's subjective role. It is no longer a single inculcated knowledge by teachers. Rather, under the inspiration and guidance of teachers, they actively carry out thinking activities, promote the development of thinking, and improve their abilities.

c. *Effectively Cultivate Students' "Four Abilities"*

China attaches great importance to the cultivation of students' "four abilities". The essence of mathematics heuristic teaching is mainly to solve and discover problems by students autonomously [5]. In mathematics classrooms, teachers use heuristic teaching to change students' passive learning patterns, inspire and guide students to think positively to discover problems, interact with teachers and students and encourage students to ask their own questions, let students learn with doubts, and then inspire students to think guide the students to analyze the problem, find a way to solve the problem and gradually solve the problem, so as to achieve the goal of improving the ability of students to find and propose problems, and to analyze and solve problems. Throughout the process, the students "four abilities" are effectively cultivated.

III. Effective Implementation of Heuristic Teaching to Cultivate Students' "Four Abilities"

A. *Cultivate the Ability to Find and Ask Questions*

Mathematics knowledge in high school is often abstract and difficult to understand. As the age increases,

students become more and more challenging in learning mathematics. Teachers, as guides for student learning, should play a guiding role in high school mathematics classrooms. For example, teachers can create situations in specific teaching, cut in from students' familiar life examples according to the teaching content, use the teaching method of student activity method, through some practical operations, field measurement, visit models, etc., to make students have an intuitive feeling and attract Students' attention, arouse students' curiosity, arouse and cultivate students' problem awareness, inspire students to understand mathematics from their lives, and find problems from the perspective of mathematics, inspire students' initiative and motivation to learn the joy of finding problems. The application of heuristic teaching in mathematics teaching can guide students to think and discover mathematical problems, thereby cultivating students' ability to find problems.

In the course of high school classroom mathematics teaching, it is necessary to reflect the dominant position of students, pay attention to the effective interaction between teachers and students, and implement question-based heuristic teaching can effectively improve classroom teaching effects [6]. Teachers can inspire and lead students through the teaching method of teacher-student conversation method, and through the question and answer between teachers and students. Teachers should pay attention to the pertinence of problems under the premise of clear teaching objectives, break through the key points and difficulties of teaching, and learn to grasp the key. On the basis of fully understanding the students' cognitive laws and students' existing knowledge structure, pay attention to the difficulty of asking questions. Teachers should carefully design questions and use appropriate methods to ask questions. They must be innovative and inspiring. The language should be concise and precise, and there should be no academic mistakes. In the teaching process, not only the teachers have to ask questions, but also guide and encourage students to express their own opinions, boldly participate and ask questions [7], so as to cultivate students' ability to ask questions.

B. *Cultivate the Ability to Analyze and Solve Problems*

As far as our country's current society attaches importance to the college entrance examination, training students' ability to analyze and solve problems is particularly important. In the high school mathematics classroom, due to the strict logic of mathematics, teachers should fully and accurately grasp the existing mathematical cognitive structure of students [8], and guide students to observe and compare based on the existing knowledge structure of students. And gradually inspire students to analyze the problem in layers, and after a certain amount of inspiration, teachers should give students a certain amount of time and space for thinking, waiting for the opportunity to dial at the right time. Let students experience the application of mathematical thinking in the entire analysis of problems, pay attention to the mining, sorting and explanation of thinking methods, and consciously cultivate students' mathematical thinking methods [9]. Just as there was a saying in ancient times: teaching people to fish is worse than teaching people to fish. In the teaching of high school mathematics, students should not only get scattered mathematical knowledge in the classroom, but should form mathematical thinking, master learning methods, learn how to analyze problems, and cultivate the ability to analyze problems.

Under the guidance of teachers, the ability to analyze problems has been gradually improved, so that they have been trained in problem-solving ideas. Teachers can also design variants to inspire students to learn. "Inferences and inferences" are one of the purposes of mathematics heuristic teaching. In particular, it is necessary to focus on the design and application of the problems of "homogeneous and heterogeneous in shape

and homogeneity in deformation", to develop students' ability to make inconsistencies [10], and to consolidate the use of knowledge. Whenever a problem is encountered, the mathematics thinking and learning methods learned will be used to solve the problem. The students will also get a feeling of emotional experience in problem solving from the process of solving the problem. Mathematics thinking methods are used, and the students ability to solve problems is also get promoted.

I interviewed mathematics teachers in a high school in Hunchun regarding the use of heuristic teaching in the high school mathematics classroom to cultivate students' "four abilities". The result of the interview is that the school's mathematics teachers believe that heuristic teaching is necessary. On the question, the school's mathematics teachers all expressed that they attached great importance to heuristic teaching. By increasing the frequency of enlightening questions in the classroom, focusing on the interaction between teachers and students, and trying to adopt some heuristic teaching methods. The school's mathematics teachers believe that heuristic teaching takes students as the main body, allowing students to actively participate in the classroom, show students' personalities, cultivate students' various abilities including "four abilities", and improve students' mathematical literacy. In heuristic teaching, students have high interest in learning and high participation. They like to express their opinions, and the classroom atmosphere will be very pleasant. After heuristic teaching, students have a higher level of knowledge than traditional teaching methods. From review questions, homework completion, and test scores, heuristic teaching can be found through this process of exploring and discovering knowledge by students. The memory of knowledge is higher. Throughout the teaching process, students find problems through thinking, ask questions, and further analyze the problems under the inspiration of the teachers to solve the problems, so as to fully cultivate the students' "four abilities". The in-service mathematics teachers find heuristics in high school mathematics classrooms through practical experience teaching is effective and significant for the cultivation of "Four abilities".

IV. CONCLUSIONS, SUGGESTIONS AND PROSPECTS

The use of heuristic teaching in high school mathematics teaching can effectively cultivate students' "four abilities". As a new type of teaching method, heuristic teaching can effectively guide students' thinking process, promote the improvement of students' ability, and make mathematics the efficiency of classroom teaching has been greatly improved. As the designer of the whole teaching process, he put forward higher requirements for teachers. As a teacher, you should be proficient in professional knowledge, have a comprehensive grasp of the content of the textbook, and fully consider the actual situation of students, knowledge base, etc., and integrate all factors to design the classroom link. This requires teachers to continue to learn and practice, to enhance their own heuristic awareness, to pay attention to heuristic teaching, to think about how to use heuristic teaching design in a reasonable and clever way, and to reflect on teaching after practice, and gradually improve their teaching level. To truly stimulate students' interest in learning, cultivate the development and formation of students' mathematical thinking, cultivate students' ability to discover and raise problems, analyze and solve problems, and promote students' more comprehensive development.

Heuristic teaching will attract more and more attention, and will surely get continuous research and development. Does heuristic teaching apply to all mathematical knowledge? Is it applicable to other subjects besides mathematics? Is it effective for students of different ages such as elementary school students and junior high school students? These issues still need our continuous research in the future.

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