ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202207_5(7).0057

Research on the Strategy for the Cultivation of Middle School Students' Mathematical Problem Posing Ability

Wenqi Yu, Mingyuan Chen

School of Mathematics and Statistics, Huanggang Normal University, Huanggang, 438000, China

Abstract

With the continuous fundamental education curriculum reform, students' creative ability has also attracted much attention. How to cultivate students' creative ability in the mathematics classroom exists a topic discussed by many experts and scholars. And problems as the source of mathematical development are also the basis of mathematical innovation. This paper tries to analyze the current situation and influencing factors of middle school students' mathematical problem posing ability.Put forward strategies to improve middle school students' mathematical problem posing ability and provide thoughts for teachers in classroom teaching.

Keywords

Mathematical problem posing ability; Cultivation strategies; Middle school students.

1. Introduction

With the development of the times, the concept of mathematics classroom teaching is quietly changing, from traditional teaching and students accepting learning to the teacher as the organizer of education, guiding students to learn knowledge actively. Teaching models are blossoming due to constantly updated and progressive teaching concepts and ideas, which significantly broaden the ways and means of classroom teaching. Flexible teaching models create the conditions and possibilities for rapidly improving students' intrinsic learning abilities.

The curriculum objectives of the general high school mathematics curriculum (2017 edition) state that: Through the study of the high school mathematics curriculum, students should be able to have the "Four bases and four abilities" to establish the scientific spirit of questioning, good thinking, and rigorous and realistic [1]. At present, China's development has been in the stage of high speed and high-level development. The demand for talents has put forward higher standards and requirements. Keeping up with the times and the needs of society, we should cultivate students' problem awareness. Therefore, it is imperative to facilitate students' problem awareness and guide them to find and analyze problems in mathematics classroom teaching.

Since the 1990s, our primary education has begun to change from "examination-oriented education" to "quality-oriented education," which has led to a significant discussion on "quality-oriented education" in mathematics education [2]. As a result of the reflection on the teaching of "problem-solving," mathematics education researchers and mathematics teachers have started to research the learning of problem posing in mathematics. The research on the learning of problem-posing has slowly changed from a summary of teaching experience to empirical study and theoretical construction over the past ten years [3]. It is worth studying how teachers can guide students purposefully, changing from teachers asking questions to students asking questions. In the classroom today, it is clear that students' awareness of problems is poor, and

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202207_5(7).0057

their ability to ask questions is lowly. As educators, we need to think about why students have these problems and find strategies to improve teaching and enhance students' abilities.

2. The Current Situation of Middle School Students' Mathematical Problem Posing Ability and Influencing Factors

To have the problem-posing ability, students should be good at finding problems, that is, having a good sense of mathematics problems. Through the survey interviews, I found that students' ability to see problems is weak mainly because students' basic knowledge of mathematics is not firm enough. To find the trial is required to learn the relevant knowledge to explore surface characteristics. However, in the past, classroom teaching has made students acceptable mechanically. When they encounter mathematical problems, they do not even think about problems and wait for the teacher's answers. Although this saves time for students, in the long run, students' problem awareness and inquiring spirit are worn out, which is not conducive to students' growth.

At the same time, the connection between problems and problems is also logical. Students need to have good analytical reasoning ability if they want to connect a simple problem to a deeper problem. With such a good conversion ability, students can look through the surface to understand the depths to find issues and then ask questions, which a large proportion of students do not have.

According to the questionnaires and interviews, it was found that students' motivation to identify and ask questions differed from grade to grade. In terms of the questions' quality, most students can only ask conventional and straightforward questions based on the known conditions given in the questions. The weakness of students' divergent thinking and problem awareness also leads to a low number of questions and a single perspective. Most of the students interviewed confessed that they did not want to ask questions in class. And when asked about the reasons for this, there are several categories: First, they are used to waiting for the teacher to throw out problems in class and start to solve them, and once they get stuck in their thoughts, the teacher will naturally help to solve them, so you don't need to take too much initiative. And many students think that mathematics is to solve problems; as long as they can master the methods, it does not matter whether they can ask questions in the mathematics classroom;

secondly, their ability is not enough, and there is a shortage in expressing the problem clearly. They cannot link up all aspects of the problem; the problem awareness is not strong. Suppose the issues can not be combined with what they have learned to find the characteristics of the problem, and naturally, there is no initiative to raise the concern. In that case, the clever woman is also difficult to cook without rice.

In addition to the students' factors that lead to the low ability to ask questions, the external environment in which students also live negatively impacts them. Most notably are the influence of the classroom environment on students; the dull classroom teaching atmosphere and a single teacher teaching style are making students less motivated to learn mathematics, not to mention participating and discovering mathematical problems in the classroom. Teachers in the classroom teach knowledge that is immediately supplemented by many practice problems so that students are busy doing problem training. There is no time to think, let alone question, and students slowly lose interest and motivation to think about mathematical problems, the initiative to explore the nature of the problem.

We found that many students have their problems in the classroom, but they are often reluctant to bring them up. Mainly because they are afraid to ask questions will cause the teacher's

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202207_5(7).0057

dissatisfaction; if the teacher does not seem to have any meaningful questions, they will be criticized and teased by their classmates.

3. Strategies to Improve Middle School Students' Mathematical Problem Posing Ability

Teachers need to implement problem-posing teaching in the classroom to improve students' mathematical problem posing ability. The most central point of problem-posing teaching is that teachers should guide students throughout the teaching process to let students take the initiative to question. Then the teacher starts by asking questions, then leads the students to think and ask questions, and then uses the questions to promote the overall teaching and learning of the classroom.

3.1. Setting Goals as A Guide for Students

Constructivism believes that students should acquire knowledge by actively constructing it rather than passively receiving it. If you want students to complete knowledge in classroom teaching actively, teachers must set a clear goal for students. Gary D. Borich, in Effective Teaching, has explained practical questions this way: "Questions that students can actively organize their responses and therefore actively participate in the learning process are effective questions [4]. In problem-posing teaching, the teacher's questions must be precise and purposeful. If the questions are vague, students will not be able to understand the intent and will deviate from the direction of their thinking. Teaching objectives are the basis of instructional design and a measure of teaching quality. They can be set to arouse students' motivation to explore or recall what they have previously learned and relate it to their current classroom learning.

When setting objectives for students, it is also important that the purposeful questions set by the teacher must be relevant to current learning. So that students can understand the teacher's intentions and think more deeply within their abilities to try to ask more groundbreaking questions.

For example, Explore the conditions under which a triangle can be divided into two isosceles triangles. The teacher gives several groups of triangles (the first group is an isosceles triangle with a base angle of 30 degrees, the second group is a right triangle with an acute angle of 30 degrees, and the third group is an acute triangle with triangles of 80 degrees, 75 degrees, and 25 degrees, respectively) and asks the following question: Can these triangles be divided into isosceles triangles? Please draw the division lines and explain the reasons if you cannot.

Teacher: By trying, is that all triangles can be divided into isosceles triangles?

Student A: It has to meet certain conditions.

Most of the students approved.

Teacher: With this problem, what conditions do you think are needed to divide a triangle into isosceles triangles?

Student A: I think it is essential to find at least one angle equal to a known angle.

Teacher: we need to look for an angle equal to the known angle.

Here is the guidance of the triangle division conditions. Because the goal is clear, the teacher also accurately raises whether all triangles can be divided into isosceles triangles. Combined with several groups of different triangles found that this conclusion can not be established, students A then realized that this conclusion is not complete, may need to have certain restrictions. It is based on the students' own intuitive understanding of the problem. They are

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202207_5(7).0057

able to identify problems and formulate their own ideas after the teacher has posed thought-provoking questions.

3.2. Use Situations as A Vehicle to Inspire Students

Good problem situations are the basis for students to discover mathematical problems. Creating different problem situations for students can help students' motivation to think about issues. Students can get different conclusions from different perspectives because of their differences in the problem situations. Teachers can link mathematical problems with other subjects. Teachers can guide students to look at problems from a mathematical perspective, stimulating students' interest and enthusiasm in learning mathematics and exploring problems. More importantly, they can develop students' problem awareness. According to zone of proximal development theory, in the right problem situation, teachers can use the situation to cause cognitive conflicts among students, and with mental disputes, there will be thinking. Students will tend to discover further and analyze problems and then ask meaningful questions.

It is important to note that not all scenarios are meaningful for students' deep learning. Suppose teachers do not set up appropriate problem scenarios and guide students. In that case, students may ask questions based on the circumstances they think are significant from their perspectives, and they will go misadventure.

For example, in the study of the definition of "even function." Before the function graphs of $y = x^2$and $y = |x| + 2$, the teacher can playback such as the Forbidden City, the Temple of Heaven, Tiananmen Square, and other architectural composition. Let students experience the beauty of symmetry. And then show the graph and its function of calculating the value of the corresponding table. The teacher can be oriented to ask questions: What are the common features of the graphs from the symmetry point of view? Students will naturally find that the charts of the two functions are symmetric about the y-axis. Eventually, the students will summarize the concept of even functions, which fully reflects the teacher's questioning orientation to help students find the problem is constructive.

3.3. Emphasis on Meta-cognitive Learning

We found that many students do not actively reflect in their daily learning life in the interview survey. Inside and outside the classroom, many students often do not profoundly understand their internalize mathematical knowledge. The mathematics educator Polya emphasizes reflective meta-cognitive learning[5], that is, having some thoughtful questions during mathematical problem-solving. At the same time, students think and reflect in the form of self-dialogue format. This reflection by students in the learning process helps them deepen their understanding of the problem as they identify and solve it. This kind of reflection is good for exploring the surface features of a problem or its inner connections and patterns to facilitate the effect.

Students' behavior can be autonomous under the guidance of teachers. In this process, teachers should take care to organize the reflective materials. In the implementation of teaching can be used to put students in the problem situation. Teachers should encourage students to speak up and praise them for actively participating in problem discussions. Students are evaluated more comprehensively for their participation in cooperative group activities and for their highly reflective and motivated performance. Let students experience meta-cognitive monitoring and become good at self-reflection. Another element that teachers tend to overlook is the review lesson. Reviewing is not only a good way to check for gaps, but also a good way to review old knowledge. Teachers should guide students to develop the habit of reviewing old knowledge and sorting out new knowledge, which may lead to new gains on certain skipped issues. All of these can reflect students' reflective learning, and teachers should pay attention to guiding students to reflect on the intellectual level and the mental level.

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202207_5(7).0057

3.4. Improve Teachers' Professionalism

Teachers are the organizers and guides of teaching, but they are also the role models for students to learn from. We advocate the concept of lifelong learning as a teacher, not to stick to the rules but to improve our teaching methods. To cultivate students' awareness of problems, teachers need to have good professional quality. Teachers need to guide students to think not only about knowledge in the classroom but also about knowledge outside the classroom, which requires teachers to have a good grasp of the knowledge system of each school period .

The new curriculum proposes cultivating the six core literacies and four competencies of students, which requires teachers to study the curriculum carefully, study the teaching materials thoroughly, and continuously improve teaching methods. Students should reflect on their learning, reflecting on whether they have set good teaching goals, grasped the important and difficult points.

In the interview, we find that many teachers teach mainly through lecture or a combination of lecture and practice. Such a teaching method is single. Students in such a method can quickly develop the habit of following the teacher's steps and passively accepting learning. Although such a teaching method, in the teacher's view, can be suitable for students to consolidate what they have learned and improve their performance through practice, in the long run, it is not conducive to the development of students' creative thinking.

In the classroom, teachers generally behave harshly to severe classroom discipline. Students do not dare to do anything and do not dare to ask questions. Over time the students' thinking is no longer active, so in the classroom, teachers should make full use of the opportunity to communicate between students and teachers and encourage students to ask questions so that they have the courage and confidence to ask questions. During this period, teachers should observe students' speech performance and create different performance opportunities for each student as far as possible so that students can participate more deeply in the classroom and deepen their learning of mathematical knowledge in the questioning thought.

4. Summary

Students' problem-posing ability is the basis for developing their thinking and improving their creative abilities. As mathematics is a highly theoretical course closely related to our lives, it is essential to develop students' problem-posing ability in mathematics classroom teaching. This paper analyzes the current situation of problem-posing of secondary school students and its influencing factors based on survey interviews. From students' internal factors such as ability and interest to the influence of external factors such as classroom atmosphere and teachers' teaching style, I think teachers should be student-oriented. Improve their teaching style and train students while improving their professionalism. Teachers should pay attention to cultivating students' problem awareness and putting students' questioning throughout the teaching process.

Acknowledgments

Fund Project: supported by The Graduate Workstation Project of Huanggang Normal University (5032021018).

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202207_5(7).0057

References

[1] People's Republic of China: General high school mathematics curriculum standards (2017 edition)(People's Education Publishing House, Beijing,2017).

[2] Xiaogang Xia: Research on teaching mathematics based on asking questions (Guizhou People's Publishing House,Guiyang,2008).

[3] Genan Pan: A few thoughts on problem posing in mathematics, Journal of Hefei Normal College, 2009.

[4] Yingying Zheng: Research on problem design in high school mathematics "quality class", Xinyang Normal University, 2017.

[5] Polya, Hong Tu and Chengtian Feng: How to solve problems: A new approach to mathematical thinking, (Shanghai Science and Technology Education Press, Shanghai,2011).