Education Reform and Development, 2025, Volume 7, Issue 8
https://ojs.bbwpublisher.com/index.php/ERD
Online ISSN: 2652-5372
Print ISSN: 2652-5364

Teaching Strategies of Junior High School Mathematics Classroom Based on Problem-Driven Method

Zhenzhen Liu*

Urumqi No. 108 Middle School, Urumqi 830000, Xinjiang, China

**Author to whom correspondence should be addressed.*

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Abstract: With the in-depth advancement of the new curriculum reform, the cultivation of subject literacy has become the focus of basic education, which also puts forward higher requirements for teaching work. The problem-driven method is a teaching model that emerged in the context of educational reform, and it meets the requirements of the new era's educational reform. Under the application of the problem-driven teaching method, teachers should strengthen teaching work, emphasize the problems, key and difficult points in teaching, encourage students to think in depth, and help them form comprehensive quality and ability. Based on this, this paper deeply explores the principles of problem-driven teaching design in junior high school mathematics, and on this basis, puts forward the classroom teaching strategies of junior high school mathematics based on the problem-driven method, hoping to provide useful references for more junior high school mathematics educators.

Keywords: Problem-driven method; Junior high school mathematics; Classroom teaching

Online publication: August 29, 2025

1. Introduction

Questions are an important means for teachers and students to achieve in-depth interaction and communication, and a key way for teachers to inspire students' thinking. In the process of junior high school mathematics teaching, teachers can arouse students' curiosity by raising questions, drive students' thinking through questions, and truly enable students to engage in learning activities immersively to achieve in-depth learning. To this end, teachers should strengthen teaching design, create a good teaching situation, actively organize students to participate in learning practice activities, and cultivate students' innovative awareness based on inspiring their autonomous learning ability.

2. Principles of problem-driven teaching design in junior high school mathematics

2.1. Inspirational principle

The main purpose of problem-driven teaching is to arouse students' enthusiasm for learning, guide them to think and explore in depth, help them better immerse themselves in learning and practice activities, master key mathematical knowledge, and develop problem-solving abilities [1]. Therefore, teachers should design problems based on teaching content to inspire students' thinking and further enhance their learning enthusiasm. Implementing the inspirational principle not only requires considering the content and presentation methods of the problems but also involves thinking about how to provide targeted assistance and guidance to ensure the effectiveness of teaching [2].

2.2. Scientific principle

Knowledge points in mathematics are relatively abstract, requiring students to have certain logical thinking abilities and problem-solving skills. The content design in mathematics textbooks is relatively scientific, which conforms to the characteristics of students' learning and development. Teachers should fully consider the scientific nature of teaching in the process of teaching design, design more scientific and rigorous problems, and ensure the effective implementation of teaching. They should emphasize the standardization of mathematical language, clarify the difficulties and key points of the problems, choose appropriate timing for questioning, and guarantee the effective progress of teaching [3]. Moreover, during teaching, teachers should make full use of online teaching resources, take problems as the driver to guide students to think and explore independently, fully embody the scientific principle, and help students master key learning qualities.

2.3. Progressive principle

The development of all students' thinking abilities is a cyclical and ascending process, and the learning potential of many students remains to be tapped. Teachers should carry out teaching work in combination with this characteristic of students to ensure that the teaching content is hierarchical. In the application of problem-driven teaching methods, it is necessary to grasp the degree of problem design, start from the actual level of students' thinking development, construct a clearer and more comprehensive knowledge structure system, and make the problems show progressive characteristics. Only in this way can students achieve efficient learning [4,5].

3. Junior high school mathematics classroom teaching strategies based on the problem-driven method

3.1. Updating educational concepts and reshaping teacher-student relationships

In the context of quality-oriented education, cultivating comprehensive talents with high-quality standards has become the focus of junior high school education. To this end, junior high school mathematics teachers should change their educational concepts, realize that scores are not the only indicator to measure students' learning, and make it clear that classroom teaching not only serves exams but also needs to closely focus on the content of mathematical literacy to determine teaching goals and requirements, thereby building efficient classrooms. At the same time, junior high school mathematics teachers should also pay attention to the shaping of teacher-student relationships, focus on students' learning characteristics and needs, carry out targeted teaching work, and cultivate high-quality talents [6,7].

3.2. Carefully designing questions to promote thinking development

As the focus of subject teaching, questions are the key to mobilizing students' enthusiasm for learning mathematical knowledge. The same applies to mathematics classroom teaching; scientifically designing high-quality questions is crucial to ensuring the smooth progress of teaching. Therefore, under the problem-driven teaching model, teachers should scientifically design teaching questions so that students can conduct in-depth thinking under the guidance of questions, thereby improving their enthusiasm, broadening their learning horizons, conducting in-depth learning of knowledge, and forming key mathematical thinking abilities [8–11].

For example, in the process of designing questions, teachers should fully consider three aspects: "what it is, why it is, and how to do it". Firstly, teachers should conduct in-depth analysis and research on textbooks, dig deep into the mathematical knowledge involved, and carefully design teaching questions. When designing mathematics teaching questions, teachers should also deeply grasp the key and difficult points of teaching to scientifically design questions. Only in this way can we better ensure the development of teaching work and realize the value of mathematical questions. Secondly, in the teaching process, teachers should focus on students' characteristics, design questions closely around the student-centered education concept, and design questions based on students' zone of proximal development. On the premise of students' mathematical foundation, cultivate their comprehensive quality and ability, ensuring that students think deeply about problems under the guidance of questions, and achieve improvement in comprehensive quality and ability. Finally, when designing questions, teachers also need to consider the process of students' thinking development, rather than just presenting the standard answers to mathematics [12].

3.3. Creating problem scenarios to stimulate students' motivation

After designing problems, teachers need to consider students' learning status and focus on how to engage students in learning activities. Therefore, during classroom teaching, teachers should emphasize creating problem scenarios that combine abstract mathematical knowledge with real-life issues. This helps students deeply understand knowledge points and improve their inquiry abilities. In the problem-driven teaching model, junior high school mathematics teachers should also carefully design teaching scenarios to stimulate students' desire for exploration through these scenarios. By connecting mathematical knowledge with real life and using life phenomena, students can understand key problems, discover rules, acquire knowledge, and achieve efficient learning and development [13–15].

For example, in the teaching of "Determining Positions", teachers can use multimedia to present daily life scenes, such as introducing the scenario of "watching a movie". During the Spring Festival, the movie Nezha 2 is released, and Xiaohong goes to the cinema with her parents. Students are asked to help them find their seats. Teachers guide students to think about how to accurately find the seat indicated on the movie ticket and confirm the corresponding seat number. Questions raised by teachers include: Are seats 5 in row 8 and seat 8 in row 5 the same? What do the numbers 8 and 5 on the ticket mean? What does (8,5) represent? After putting forward these questions, teachers let students think deeply and analyze them based on their own life experiences, which helps establish a close connection between mathematical knowledge and real life.

3.4. Providing waiting time to encourage in-depth thinking

The process of solving problems involves a series of steps, requiring students to conduct in-depth analysis and thinking after hearing the questions. This process demands a certain amount of time and energy from students. Especially for junior high school students, they need ample time for thinking and adaptation, as well as in-depth

analysis of problems to understand the knowledge points involved [16]. During teaching, teachers should pay attention to the following issues: First, focus on hierarchical guidance. Since students have different learning foundations and abilities, it is necessary to provide hierarchical guidance in the implementation of the problem-driven method. Offering optional questions with varying difficulty levels allows students to answer according to their situation. Second, direct classroom questions to all students and randomly call on them. This encourages students to think actively and engage in learning activities [17]. Finally, teachers should closely monitor students' learning status. When students encounter difficulties, provide more help and support, identify typical correct and incorrect answers, and conduct targeted analysis and guidance. This helps students understand the problems, acquire relevant learning ideas, and achieve good learning results [18].

For example, in the teaching of "Exploring the Conditions for Triangle Congruence", teachers can set the question: What conditions do we need to know to construct a triangle congruent to a given triangle? Then, teachers provide students with time for in-depth thinking and exploration, and encourage them to communicate with group members. During teaching, teachers randomly call on students to answer. Students may propose several possibilities: three sides, three angles, two angles and one side, two sides and one angle, etc. Teachers continue to ask in-depth questions to guide students to draw corresponding conclusions [19].

3.5. Strengthening teaching guidance for in-depth problem analysis

In the application of the problem-driven teaching method, to help students quickly enter problem scenarios, teachers need to analyze key mathematical problems. Students' thinking process about problems is also a process of their thinking transformation, which is crucial for developing their mathematical thinking abilities. In the problem-driven teaching model, teachers should change traditional educational concepts, develop students' mathematical thinking qualities, and stimulate their innovative thinking abilities. In this process, teachers should give full play to their guiding role, analyze specific problems, and help students deeply explore the internal ideas and connotations of knowledge during thinking and analysis. Students also need to strengthen cooperative learning, think and discuss problems in groups, so that they can form a comprehensive understanding of problems during the thinking process [20].

3.6. Problem-driven teaching model

The problem-driven teaching model requires teachers to be problem-oriented and guide students to actively explore and apply mathematical ideas in the process of solving problems. For this purpose, teachers can design a series of inspiring and hierarchical problems for students, gradually guiding them to think in depth, to cultivate their logical thinking and innovative abilities. Take, for example, when a teacher is explaining "Judgment of Congruent Triangles." The teacher can first show students two triangle teaching aids that look the same and then ask, "Students, here are two triangles. Take a look, do they seem the same? How can we be sure that these two triangles are exactly the same, that is, congruent?" This question triggers students' initial thinking. At this point, some students may make judgments based on their intuitive feelings but cannot accurately explain the basis for their judgments. Then the teacher can arouse their desire to explore further. Next, the teacher can give students the definition of congruent triangles: two triangles that can completely overlap are called congruent triangles. Then, the teacher can follow up with a question: "According to the definition, to verify that two triangles are congruent, we need to cut them out and put them together to see if they overlap. But is there a simpler way to determine it only through the relationship between the sides and angles of the triangles?" This guides students to start thinking about the conditions for judging triangle congruence from the perspective of sides and angles.

After students have thought and discussed, the teacher can introduce the first judgment theorem, "Side - Side - Side" (SSS). Specifically, the teacher first presents two triangles with three groups of corresponding sides equal respectively and asks the students, "Now we know that the three sides of these two triangles are corresponding equal. Can you make them overlap through geometric transformations such as translation, rotation, and reflection? Have a try by yourselves." This guides students to intuitively verify the correctness of the "SSS" judgment theorem through practical operations, and at the same time, students deepen their understanding of the mathematical idea of geometric transformation during the operation. When students have mastered the "SSS" judgment theorem, the teacher can put forward a more challenging question to them: "If we only know that two sides and one angle of two triangles are corresponding equal, are the two triangles necessarily congruent? Are there any special requirements for the angle here?" This then triggers students' discussion on the situations of "Side - Angle - Side" (SAS) and "Side - Side - Angle" (SSA). At this time, through group discussions and drawing analysis, students can find that when two sides and the included angle are corresponding equal, the two triangles are congruent, that is, the "SAS" judgment theorem.

However, the situation of "SSA" cannot determine that two triangles are congruent, and it needs further analysis. Through this process, teachers cultivate students' mathematical thinking of classification and discussion, as well as their logical reasoning ability. After explaining the "SAS" judgment theorem, the teacher can further ask: "What if two angles and one side of two triangles are corresponding equal? What situations will there be, and can they determine the congruence of triangles?" With this question, students are guided to explore the "Angle - Side - Angle" (ASA) and "Angle - Angle - Side" (AAS) judgment theorems by themselves. Students can finally draw the corresponding judgment theorems through analogizing the previous learning methods, such as drawing, analyzing, and discussing. When students have mastered multiple judgment theorems, the teacher can give them some comprehensive practical problems, such as: "When building a bridge, workers need to measure the distance between two opposite points A and B on both sides of the river, but it cannot be measured directly. It is known that a point C can be determined on the riverbank such that AC is perpendicular to the riverbank, and the length of AC, the degree of $\angle ACB$, and the degree of $\angle CAB$ can be measured. How can we find the length of AB using the knowledge of triangle congruence judgment we have learned?" Since this problem combines the knowledge of triangle congruence judgment with measurement problems in real life, teachers can require students to use the learned mathematical ideas and knowledge and establish mathematical models to solve practical problems, which can further improve students' application ability and innovative thinking.

4. Conclusion

In summary, during the teaching process of junior high school mathematics, teachers should pay attention to the application of the problem-driven method. They should take problems as the guide to encourage students to think and explore, thereby helping them deeply understand knowledge, master key problem-solving methods, form essential thinking qualities, and provide more help and support for students' development. Teaching practice is a process of continuous improvement. Teachers need to design problems scientifically, flexibly adjust teaching work according to students' cognitive rules and living conditions, and ensure the effectiveness of teaching. Looking forward to the future, educators still need to continuously strengthen the research on the problem-driven method to improve the effectiveness of mathematics teaching and promote students' growth and development.

Disclosure statement

The author declares no conflict of interest.

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