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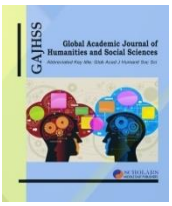

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Original Research Article

Research on the BOPPPS Teaching Mode of Number and Algebra in Junior Middle School Mathematics

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Abstract: BOPPPS teaching mode is a goal-oriented and student-centered teaching mode. It emphasizes students' participatory learning and attaches great importance to classroom interaction and inquiry. In order to change the disadvantages of traditional teaching, this paper discusses the perfect fit between this model and the "number and algebra" classroom in junior high school mathematics. On this basis, a series of teaching strategies are provided for reference. The teaching process of "number and algebra" under the BOPPPS teaching mode is constructed. This provides experience for junior high school mathematics teaching.

Keywords: BOPPPS Teaching Mode, Number and Algebra, Teaching Strategies.

1. INTRODUCTION

The BOPPPS (Bridge-in, Objective, Pre-assessment, Participatory Learning, Post-assessment, Summary) teaching model originated in Canada. It is the theoretical basis of ISW, a widely practiced teacher skills training system in Canada [1]. This model divides a lesson into 6 interconnected stages. It constructs a complete teaching process centered on achieving the teaching goals. With its significant advantages such as structured teaching process, clear learning goal setting, deep student engagement and immediate feedback system, the BOPPPS teaching model has laid a solid foundation for the improvement of teaching effectiveness.

In junior high school, “number and algebra” is divided into three core themes: number and formula, equation and inequality and function [2]. This part of the content is not only significantly more abstract and systematic, but also more difficult. Traditional teaching often focuses on knowledge inculcation and problem-solving skills training, which tends to ignore students' subjectivity and creativity. As a result, students feel boring when learning "numbers and algebra", and lack the motivation to explore and learn actively. Secondly, teachers often pay more attention to students' mastery of knowledge points while ignoring students' experience in the learning process when setting teaching objectives. In addition, in the selection and application of teaching methods, students' autonomy, cooperation and inquiry are not fully paid attention to. As a result, we urgently need a teaching method that can promote students' active participation and positive thinking in class, so as to improve students' interest and learning effect in mathematics. At the same time, it is also necessary to ensure that mathematics teaching can be carried out in an orderly manner, so that students can better master knowledge and develop their abilities in an orderly learning environment.

BOPPPS teaching mode provides a new way of thinking for the teaching in the field of number and algebra. It ranges from the fun of introduction, the clarity of goal setting, the timeliness and feedback of pre-test and post-test, to the interactivity of participatory learning, and then to the generality and

enlightenment of summary. This series of processes not only meets the requirements of improving students' participation and learning enthusiasm, but also helps to build a student-centered classroom, a more vivid and efficient interactive "number and algebra" mathematics classroom.

2. RESEARCH RESULTS AND DISCUSSION

2.1 BOPPPS Teaching Strategies of "Number and Algebra" in Junior Middle School Mathematics

1) **Bridge-in (B):** Bridge-in is not only the beginning of course teaching, but also the key to the success of the whole teaching process. It directly affects students' learning interest and concentration. In view of the abstraction of the content of "numbers and algebra", teachers can either review old knowledge, build bridges, or set suspense to arouse curiosity, or connect with life and enhance experience. We can try to adopt various import methods, such as situation import, story import, question import, game import and so on. Present the imported content in a novel and interesting way to enhance students' concentration and promote participation. In addition, the leading-in should be natural, concise and clear. Try to avoid lengthy and complicated introductions and ensure that students' attention is quickly attracted within a limited time.
2) **Objective (O):** Goals provide clear direction and guidance for learning actions. On the one hand, teachers should refine their teaching objectives. From clarifying the national educational purpose, grasping the overall requirements of curriculum standards for mathematics teaching, to formulating unit teaching objectives in combination with specific teaching materials and teaching requirements. Then the unit teaching objectives are further decomposed into class teaching objectives. These goals should be highly operational. Behavioral verbs can be used to clearly describe the learning achievements that students should achieve, making the goals measurable. At the same time, the core literacy of the subject should be integrated into the teaching objectives. For example, in the teaching process of “number and algebra”, we should pay special attention to the cultivation of mathematical core literacy such as abstract ability, operational ability, reasoning ability and model concept.
3) **Pre-Assessment (P):** Pre-assessment is the key to understanding students' interests and knowledge. It is also an important basis for adjusting the follow-up teaching strategies and progress. The content of the pre-test should include some basic knowledge related to this class or previous knowledge points. Multiple-choice questions, fill-in-the-blank questions, short-answer questions and other forms can be used to comprehensively evaluate students' understanding ability and application ability. We can also take the form of oral answers. If we choose to test in class, the time should be controlled at about 3 minutes, and the longest time should not exceed 5 minutes. If we choose to do it before class, an appropriate increase in the number and types of questions can evaluate students' preparatory knowledge more comprehensively. However, it is also necessary to ensure that the time is controlled within 10-20 minutes, so as not to bring excessive burden to students.
4) **Participatory Learning (P):** The core of BOPPPS teaching mode lies is participatory learning. In order to make students actively participate and be willing to explore, teachers need to flexibly match different teaching tasks according to different class types to ensure that teaching activities are challenging and can stimulate students' interest in learning. In order to make students think diligently and enhance their ability of cooperation and communication, teachers can set questions with inquiry value, organize students to discuss in groups and study cooperatively, and finally complete the class report, so as to realize the wide application value of the content of "numbers and algebra" in real life. We can also use teaching AIDS or information technology software to assist teaching, so that students can operate under the guidance of teachers. Throughout the process, teachers should always pay attention to students' learning progress and give them timely and concrete evaluation and feedback.
5) **Post-Assessment (P):** There are many forms of post-assessment. Teachers can choose to present exercises in class, so that students' answering time should be controlled at about 3 minutes. Pay attention to ensure that the core knowledge points of this lesson are fully covered. Teachers can also ask questions to examine students' ability to understand and apply knowledge. Post-assessment must pay attention to the typicality, hierarchy and appropriateness of the problem setting.
6) **Summary (S):** First of all, teachers should guide students to summarize independently. For example, ask students to draw a mind map of this lesson, organize a small brainstorming activity, or review and summarize the key contents of this lesson through a dialogue between teachers and students. Then, the teacher should make a comprehensive summary. While reviewing and reaffirming the teaching objectives of this lesson, guide students to reflect on the learning process of this lesson and provide guidance and suggestions for students' follow-up study.

2.2 BOPPPS Teaching Process of "Number and Algebra" in Junior Middle School Mathematics

1. In order to help students better master the knowledge and skills in the field of "number and algebra". A complete teaching process should be designed to ensure that students can get comprehensive support and guidance in the whole learning process, which fully reflects the comprehensive attention to the teaching process and the careful planning of students' learning paths. The teaching process is shown in Figure 1:

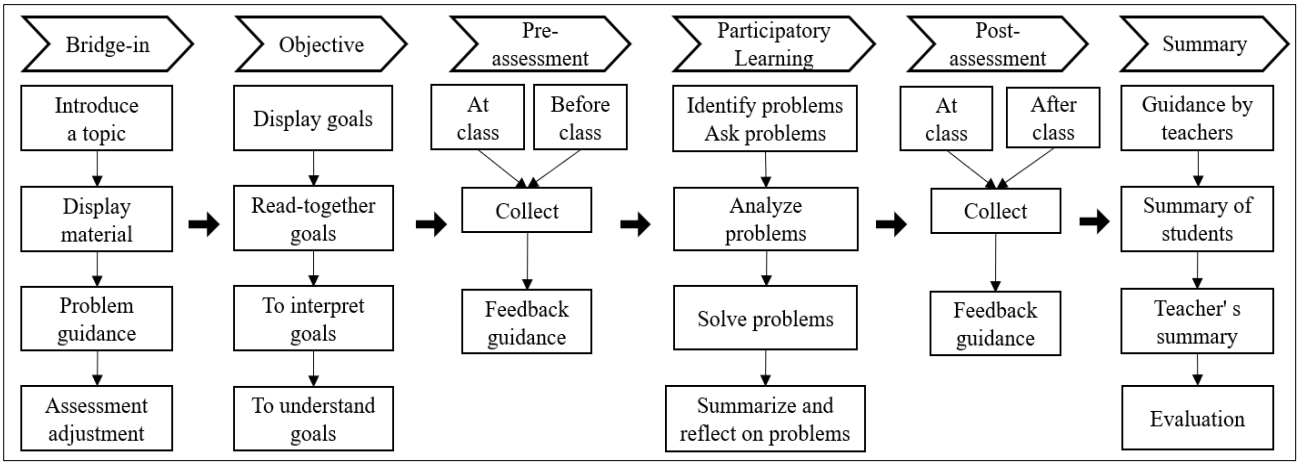

Figure 1: Teaching flow chart

2. Based on the importance of participatory learning, we should fully realize that students are the main body of cognition and the active constructor of knowledge meaning, and teachers play the role of helping and promoting students' meaning construction in this process [3]. On the basis of the whole teaching process, the process of participatory learning is designed in detail. Each step is aimed at matching different tasks between teachers and students. This ensures that teachers' teaching and students' learning are closely linked and complement each other, so that teaching and learning can learn from each other. As shown in Figure 2:

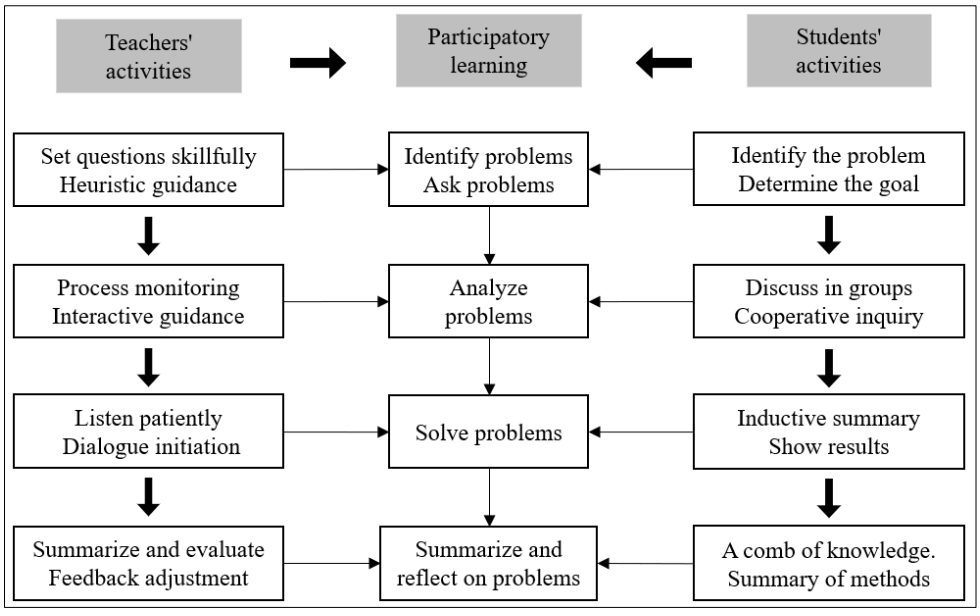

Figure 2: Teaching flow chart of participatory learning

3.3 Case Reference

Based on participatory learning, teachers should follow the problem-driven principle. This principle emphasizes the problem as the starting point and core of teaching, so as to guide students to make clear the direction and goal of learning. Teachers need to skillfully design questions and create an appropriate space for students to explore questions. Secondly, follow the principle of process participation. It emphasizes that students can

personally experience the whole process of cognition through all-round participation of talking, doing and thinking. Students no longer just passively accept the knowledge taught by teachers, but become explorers and discoverers of mathematical knowledge. Compared with the previous passive acceptance of ready-made conclusions from teachers, the knowledge gained through personal participation and experience is more profound and meaningful. On this basis, the fractional equation is taken as an example to provide reference for the teaching design of participatory learning, the core part of the classroom. As shown in Table 1:

Table 1: Case reference

Teachers' activities (Guiding)	**Students' activities (autonomous, Cooperative, exploratory)**
1. Problem-oriented 1) How to solve the fractional equation? 2) How to transform it into an integral equation? 3) How to remove the denominator? What should we pay attention to? 4) What do you find by bringing the solutions into the original fractional equation respectively? Think about the reason. 5) Compare the similarities and differences between the two fractional equations in solving problems, and try to summarize the general idea of solving fractional equations. 2. In the process of cooperation, give timely guidance to the groups with bottlenecks in discussion and encourage students to explain their problem-solving steps. 3. Summarize the results of students' cooperation and give positive feedback. Summarize the solution of fractional equation and emphasize the key steps and common mistakes.	1) Receive the question and make a preliminary judgment on it. Explore independently first, and then find out the confusion. 2) Establish a cooperation group. The team leader organizes the members of the group to participate in the interaction. 3) According to the order of questions, members in the group help each other. This includes sharing problem-solving methods and answers, exploring doubts, summarizing opinions, and completing study lists. 4) Each group sent representatives to show the results. 5) Master the basic ideas and solutions of fractional equations. Distinguish the essence of non-solution and increasing root of fractional equation, and form a new knowledge system. 6) Start the cooperation team again to check and fill the gaps in knowledge.

3. CONCLUSION

The teaching mode of BOPPPS is of far-reaching significance for promoting the teaching of "number and algebra" in junior high school mathematics. On the one hand, it optimizes the classroom teaching structure and effectively promotes the construction and internalization of students' knowledge. This has significantly improved students' interest in mathematics learning and classroom participation. On the other hand, the introduction of this teaching mode in junior high school mathematics "number and algebra" teaching has also injected new vitality into teachers' professional growth and greatly enhanced the interaction and communication between teachers and students. This undoubtedly plays an important role in promoting students' cooperative spirit and problem-solving ability.

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