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Research on the Teaching Design of Junior High School Mathematics Pointing to Deep Learning —Take "Definition of a Function" as an Example

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Abstract: *Teaching is a way for teachers to spread knowledge to students, and deep learning is a mean to ensure the quality of teaching. This paper outlines the basic methods of mathematics instructional design under deep learning, and carries out the instructional design of deep learning based on the "definition of primary function", in order to provide theoretical and practical reference for the mathematics instructional design of front-line teachers.*

Keywords: *deep learning; instructional design; primary function*

1. Introduction

Deep learning refers to the process in which students devote themselves to, experience success, and develop around challenging topics under the guidance of teachers[1]. In the process of junior high school mathematics learning, deep learning can improve students' thinking ability, master mathematics learning methods, and develop core literacy. Therefore, it is of great significance to carry out research on junior high school mathematics teaching design oriented to deep learning.

2. Concepts and Features of Deep Learning

The study of deep learning began in the middle of the 20th century, and the concept of deep learning was formally proposed in 1970, which refers to the process of students' acquisition and development under the guidance of teachers. In this process, students learn knowledge, master methods, cultivate sentiment, and form a positive learning attitude and correct values. At the junior high school stage, mathematical deep learning has the following characteristics.

2.1. Association and structure

Before the class, the students' thinking is not blank, but comes with the existing experience in life, so needs the help of teachers to wake up. Those experiences can assist in their daily learning and further enhance their knowledge structure. The process of correcting erroneous experiences and transforming knowledge and experience to match previous knowledge structures is called association. The process of transforming new knowledge and experience into one's previous knowledge structure is called structure. Association emphasizes the awakening of individual experience, while structure emphasizes the integration of individual experience.

2.2. Activities and experiences

Activities and experiences are a matter of how deep learning works. Activities refer to behaviors that are carried out with students as the object, rather than ordinary physiological activities. Experience refers to the inner activities of students after completing activities. Activities and experiences happen in sequence. Without activities with students as the main body, there will be no experiences. Positive main activities will produce good experiences, and good experiences will also be produced in meaningful activities. In the junior high school stage, students need to learn not only the knowledge in the textbooks, but also the development process of knowledge under the guidance of teachers. That is to say, students need to actively explore and internalize the knowledge in books into nutrients for their own growth under the guidance of teachers.

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2.3. Essence and variation

Essence and Variation are about how to transfer the content in the textbook. That is to say, students can grasp the essence of the problem through deep learning, and can deduce several variants of the process through the essence. In junior high school mathematics teaching, teachers need to help students grasp the essence and internal connection of problems, which requires teachers not only to provide students with positive examples of relevant learning standards, but also to provide students with rich and typical counter-examples. . Positive examples can help students quickly grasp the core meaning of concepts, while negative examples can help students grasp the key attributes of problems.

2.4. Migration and application

Transfer and application is the process in which students apply the knowledge they have learned to practice, which requires students to have innovative spirit and practical ability, and it is also an important way to cultivate students' innovative spirit and practice. Transfer is an important way to apply knowledge to practice. Application is a specific performance. The essence is closely related to variant migration and application. Only when the essence is mastered, can better migration and application be possible.

2.5. Value and evaluation

Values and evaluations address the purpose and meaning of teaching. In junior high school teaching, during class, students should critically absorb the content taught by teachers, and should not doubt without doubt that the knowledge taught by teachers and the knowledge in textbooks must be correct, and should dare to question. The ability of students to critically absorb knowledge is not innate, but formed in the process of long-term critical absorption of knowledge. Critical absorption of knowledge is not only a means but also a training result, and the ultimate goal is to cultivate students' core literacy. Ability to form correct values.

3. The Basic Method of Mathematics Teaching Design under Deep Learning

The teaching design of deep learning requires teachers to complete the teaching design in terms of teaching materials, learning situation and teaching process. Specifically, they should master the following methods.

3.1. Selecting scenarios to promote active learning

Deep learning cultivates the literacy and ability of students to be able to rationally analyze, quickly generate ideas for dealing with problems, and make quick decisions when faced with real and complex problems. Students can exercise this ability in the process of solving practical problems, that is, situations. Teaching materials need to be combined with real situations to stimulate students' interest in learning, let students solve problems in real life, enrich students' ideas, and form cognitive methods. So how do we choose good contextual materials?

First, the context of the textbook should be linked to real life. Including daily life, social life, economic and political life and so on. Situations related to daily life help to cultivate students' ability to solve problems in daily life, situations related to economic and political life help students to understand the latest social news and cultivate students' patriotic feelings, while situations related to social life help students understand the latest social news. Help to develop students' sense of social responsibility. Second, the context in the textbook should be linked to the development of the subject. The connection between the situation in the textbook and the development of the subject helps students to understand the development direction of the subject and the development trend, which can stimulate students' interest in learning and increase their knowledge. Third, the situation in the textbook needs to establish a connection with the ideological and moral education. In junior high school mathematics teaching, teachers need to fully excavate the knowledge about ideological education in the textbook, so that students can experience the long process of knowledge discovery, not only to learn to use knowledge, but also to understand the origin of knowledge, and to cultivate students' rigorous scientific attitude and logical thinking ability. In terms of situation selection, teachers need to pay attention to: too simple situations will make it difficult for students to feel, wrong situations will mislead students, and fabricated situations will deviate from reality[2] .

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3.2. Strengthen communication and promote the explicitness of thinking

The development of core literacy requires students to solve real problems with their own knowledge through continuous practice, questioning and reflection in real life. Emphasizing basic knowledge and basic abilities is an important strategy to improve students' learning ability, and this requires paying attention to students' learning ideas and making implicit thinking explicit. For example: in the mathematics teaching of junior high school, when there is a discussion in the classroom or when students need to answer questions, we often see that when the teacher asks classmate A, classmate A does not answer, the teacher will directly say please sit down, and then let classmate B answer Question, if classmate B answers correctly, the teacher will say "very good" and continue the lecture. This resulted in a result that classmate A and many other students didn't know why this was right, and at the same time they didn't know how to think of it. The teacher didn't know where student A's thinking barrier was, and they didn't communicate further.

So what should teachers do in teaching? First, teachers can allow students to analyze themselves and make their thinking explicit. That is to say, the teacher asks the students who answered the question correctly to talk about the ideas and methods used to solve the problem at once, causing students to question and discuss, and let the students who answered the wrong also talk about their own ideas to correct the mistakes of the students who have the same ideas. , and compare with the ideas of students who answered correctly, deepen the impression of students, prevent students from encountering the same problem and make mistakes again, and summarize methods to solve such problems. Second, teachers can guide students to question and promote explicit thinking. When answering a question produces different answers, teachers should not be eager to deny the wrong answer, but should analyze the students' thinking and guide other students to conduct extensive discussions, so as to obtain the correct answer and solve the problem. Third, teachers open up students' thinking through constant questioning. In teaching, when students' ideas cannot be opened, teachers can ask questions layer by layer, split the problem into several small questions, and open up students' ideas, not only limited to the answers in the textbook, but Guide students to generate more ideas.

3.3. Improve strategies to achieve in-depth interaction

Students need to carry out in-depth learning in the deep interaction with teachers and students. The main sign is that students apply the knowledge they have learned to the real world, and show a strong curiosity and desire to explore. So how to achieve deep interaction?

First, teachers should design challenging tasks to promote deep interaction among students. Learning tasks must be able to cultivate students' ideas and methods of actually solving problems. Good learning tasks can cultivate students' curiosity and stimulate students' learning motivation. Students must interact with real situations, so that deep learning is possible. Second, teachers should guide students to interact and complete tasks. In traditional teaching, teachers are simply imparters of knowledge, but after the core literacy is put forward, new requirements are put forward for teachers. Teachers should become the organizers of students' learning, the guides of the learning process and the problem-solving instructors. To complete such a transformation, teachers need to rationally arrange students' learning process, guide students to boldly question and fully discuss in the process of learning, avoid simplification of students' thinking, help students to clarify their ideas, and promote thinking development. Third, teachers should guide students to cooperate and exchange, and enhance the in-depth interaction between students. This is a key step in the realization of deep learning. The process of deep learning is a process of multi-person participation. Students are of similar age and cognitive style. It is easier to communicate, and the atmosphere is more relaxed and happy. At the same time, communication between students can exercise students. The ability of cooperation between students, the stronger the degree of participation of students, the greater their gains.

4. Teaching Design of "Definition of Primary Function" Based on Deep Learning

4.1. Learning objectives

Students can initially grasp the properties of primary functions, understand the relationship between primary functions and equations (groups), and form an overall understanding of functions.

Students use the method of studying the properties of function images to lay the foundation for the next study of the inverse proportional function, and through the learning of this class, they will

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experience the method of combining mathematical shapes.

The introduction of examples from real life can activate the classroom atmosphere and allow students to further appreciate the charm of mathematics.

4.2. Create a situation, review the old and learn the new

Question: In order to strengthen citizens' awareness of environmental protection, the state has formulated electricity consumption standards: if the household electricity consumption does not exceed 210 kWh per month, the electricity fee is 0.5 yuan per kWh, and if the electricity consumption exceeds 210 kWh and less than 400 kWh, the electricity fee is 0.6 yuan per kWh. Yuan, more than 400 kWh, each kWh is 0.8 yuan, set the household's monthly electricity consumption x kWh, and pay y yuan for the monthly electricity bill.

When $0 < x < 210$, what is the analytical formula of the function of y and x ?

When $210 \le x < 400$, what is the analytical formula of the function y of yand x ?

When $400 < x$, what is the analytical expression of the function of y and x ?

When $0 < x < 210$, what function of x is y ?

When $210 \le x < 400$, what function of x is y ?

When $400 < x$, what function of x is y ?

Teachers' activities: Teachers play public service advertisements to bring out the problem of electricity consumption.

Student activities: Students watch public service advertisements; complete question 1 independently, work in groups to explore and complete question 2, students observe, think, and take questions 3, 4, 5, and 6 into the next study.

Design intent: The mathematics teaching design of deep learning is introduced through real situations, and students can recall relevant knowledge according to known conditions.

4.3. Deep processing knowledge

Return to the real situation and be aware of knowledge

Question 1: There are 1,500 swans in the park. Suppose that the number of swans grows at a rate of 50 every year. After x years, there will be y swans. Write the relationship between y and x ?

Question 2:From east to west are A, B, C , the distance between A and B is 100km. Now a car starts from B and travels to C at a speed of 90km per hour.

Let x (h) represent the time the car travels, and y (km) represent the distance between the car and the ground.

Write the relationship between y and x , and determine whether y is a linear function of x ;

When $x = 0.5$, find the value of y .

Teacher's activity: Teachers raise real problems and cause students to think.

Student Activities: Students can correctly understand the problem and find out the relationship between variables.

Design intent: In the teaching design of deep learning, teachers should carefully set up rich contexts, and students should list relational expressions according to the contexts, laying the foundation for the next step to summarize commonalities.

Abstract and generalize, integrate knowledge

Question: Can you abstract the common features of the above relations? Can it be expressed in a formula?

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$$y=3x \quad y=4.5x+31.5 \quad y=3+0.5x \quad y=0.1x \quad z=60-0.1x$$

Teacher activity: guide students to extract a functional relationship, that is, $y=kx+b$, $y=kx$ to obtain the definition of a primary function and a proportional function, and summarize the relationship between the two.

Student activities: Students observe relationships, work in groups and summarize the similarities and differences between the various formulas, and the teacher gives advice.

Design intent: The process of deep learning is a process of multi-person participation. Teachers guide students to cooperate and communicate, and enhance the deep interaction between students, which is a key step in the realization of deep learning. Through group cooperation, students are given opportunities to explore and communicate, develop students' creativity in thinking, and cultivate students' ability to cooperate.

Transfer application knowledge

Application 1: Which of the following functions y is a linear function of x? y is a proportional function of x is there?

$$y=-2x+3 \quad y=-x-5 \quad y=5x \quad y=\frac{x+1}{2} \quad y=-4x \quad y=\frac{1}{x}$$

Application 2: Known function $y=(k-1)x+k^2-1$

When what value of k is, y is a linear function of x? When k takes what value, y is a proportional function of x?

Application 3: Starting from real life, can you think of an example of a first-order function? Take the group as a unit, and the members of the group will give each other practical application questions about the first-order function.

Teacher activities: Through the learning of this lesson, teachers guide students to apply knowledge.

Student activities: students think independently to solve "Application 1", group cooperation, teachers and students cooperate to analyze and solve "Application 1, 2"and complete the answering process.

Design intent: In the process of deep learning teaching, teachers guide students to reflect on the key points when solving problems, and improve students' cognition of primary functions through the explanation of "Application 1" and "Application 2".

Practice to consolidate and assimilate knowledge

Which of the following statements is correct ()

A. Not all linear functions are proportional functions B. Not proportional functions are definitely not linear functions

C. The proportional function is not a linear function D. The proportional function is a linear function

Go back to life and solve problems

Xiaoming’s family used 300 kWh of electricity in June. How much electricity did Xiaoming’s family pay in June?

Xiaohong said that his family paid 100 yuan for electricity in June. Guess how much electricity his family used in June?

Teacher's activity: Test students' understanding of knowledge through practice questions.

Student Activities: Students think independently, cooperate and communicate.

Design intent: In the process of in-depth learning, teachers need to carefully set up practice questions, and finally echo the power consumption problem in the introduction link.

Cooperation and exchange, summarizing knowledge

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Teacher activity: Let students express the relationship between primary functions and proportional functions in the form of mind maps, including mathematical thinking methods.

Student Activities: Students communicate with each other and present their results.

Design intent: In the process of deep learning, teachers guide students to summarize the knowledge and mathematical thinking methods in this section through mind maps, so that they can learn to reflect and summarize, improve learning behavior, and develop good mathematics learning habits.

5. Discussion and Conclusion

In the mathematics teaching of junior high school, the application scope of deep learning is very wide. Teachers should take into account various constraints in the specific implementation, let students carry out independent learning, establish the awareness of deep learning, and improve teaching strategies according to the actual situation of students. Strive to further improve students' thinking and ability, so as to achieve deep learning in teaching.

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