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Research article

Three Key Points of Elementary Mathematics Teaching Design from the Perspective of Deep Learning: Taking "Area of Parallelogram" as an Example

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ABSTRACT

Deep learning has become a hot topic in the field of education. With the core content of primary school mathematics subject as the core content of mathematics subject, through carefully designing problems, it causes students' cognitive conflicts, guides students to participate in learning activities, and explores deeply around challenging learning topics, so that students can experience the meaningful learning process of success and development. Deep learning focuses on students 'overall understanding of a kind of knowledge content, forms the transfer of knowledge and methods, grasps the mathematical essence of the content they have learned, experiences the mathematical thinking method of the content they have learned, and promotes the development of students' key abilities and core qualities. Taking "the area of the parallelogram" as an example, this paper explores the three main points of deep learning teaching design, closely following the core content of the subject, highlighting the nature of mathematical knowledge and the connection between communication knowledge.

Key words: Deep Learning; Instructional Design; Primary School Mathematics

The focus of deep learning is to focus on the learning process, in which students actively learn, think deeply, and deeply understand the understanding of some single knowledge points, or a knowledge group with the same or similar characteristics. Deep learning also emphasizes the communication of mathematical knowledge; experience the nature of mathematical knowledge and mathematical thinking methods in learning content, which is beneficial to cultivate students' experience in mathematical activities, improve the ability to discover and solve practical problems, and promote the formation of their key ability or discipline core literacy. Therefore, in the teaching design of deep learning of mathematics in primary school, we should focus on three key points: focus on the core content of the subject, pay attention to the nature of mathematics, and communicate the connection between knowledge.

The area of the parallelogram is a classic example in primary school mathematics. In the teaching system of plane graph area, the lesson "area of parallelogram" is the beginning of polygon area learning, which connects the basic knowledge of rectangular and square area with the subsequent more complex knowledge of triangle and trapezoidal area. Rectangles and square are figures that can be measured directly by unit area, providing students with an intuitive concept of area. However, the parallelogram, triangle and trapezoid are different, their area can not be directly obtained by simple measurement, that is to say, the teaching of parallelogram area has a key role in connecting the preceding and the following in the teaching system of plane graph area. More importantly, this lesson introduces the important mathematical idea of "transformation" to the students. Through the transformation of

mathematical ideas, students can explore the calculation method of parallelogram area. This mathematical thought method not only helps them to understand the current knowledge points, but also provides valuable ideas and foundation for them to explore the unknown plane graph area.

The article will take the area of parallelogram as an example to explore how to grasp the three main points of the teaching design of primary school mathematics.

Closely follow the core content of the subject, design teaching activities that trigger students to think deeply

The core content of the subject is the entry point to carry out deep learning and the carrier to organize deep learning, and it is to make the subject form a stable content structure and keep the same thing. The core content of mathematics is generally not a single knowledge point, but often a group of content, which can also be regarded as a knowledge group, which has common elements[1]. "Plgraphic area" is a key part of the field of "graphics and geometry", whether for simple plane graphic area measure, or more complex volume metric, in any dimension measure object learning and exploration, students need to experience a series of logical steps: first is to know the object to be measured, then to know and master the corresponding measurement units, then directly through the unit measurement, then learn to use the formula for indirect measurement, and eventually will learn knowledge applied to practice. In particular, "the area of the parallelogram" is not only a bridge for students to transition from direct measurement to formula indirect measurement, but

also a turning point for their abstract thinking from the intuitive understanding of "number" to "not counting" (i. e., using formula). Therefore, the core content of this lesson should focus on the students' understanding of the derivation process of the parallelogram area formula.

The teaching design of primary school mathematics based on deep learning should grasp the core content of mathematics, take the core content as the clue, and design the deep thinking teaching activities on this basis. In this process, the teacher designs three activities around the key content of "deriving the parallelogram area formula". In the process of the activity, more students can think by themselves, and the teachers can provide learning materials and enough time and space to think about.

Facing the area of the parallelogram calculation, students by the area of the rectangle, square calculation formula negative migration, or parallelogram characteristics such as learning experience, the most likely to produce the idea of "adjacent by" can calculate the area of the parallelogram, "adjacent multiplication" method is certain to appear, and more than use the number of the "bottom by high" this method. Therefore, the key time of this class leads the students to deny the idea of "adjacent multiplication". Therefore, the first activity is "counting squares". First of all, directly give the students a parallelogram (Figure 1), let the students find its area, there must be two different answers. At this time, the teacher presents the grid, and then move to the parallelogram, then students will appear two different number methods, one is to count the complete lattice, and then the incomplete lattice, a total output of 24 cells, then the teacher

can through the courseware students number dynamic demonstration (figure 2); the other is the left triangle to the right, it is easier and more accurate. In order to show this idea more clearly, the teacher used courseware to demonstrate (as shown in Figure 3), the whole moving triangle, the complete square, the parallelogram contains several units of area also can be easily counted with 83, the area is 24 square centimeters. The students realized that the method of "bottom ride high" might be right. The teacher continues to follow the trend, let the students think about the area of the parallelogram with the "bottom ride high" to calculate, what is the reason? Through the overall movement, the students have a new idea: cut the parallelogram along a triangle, spell to the other side, can turn into a rectangle. The length of the rectangle is equivalent to the bottom of the parallelogram, the width of the rectangle is equivalent to the height of the parallelogram, the rectangular area = the length width, so the parallelogram area = the bottom height, their area is the same. Drawing transformation (Figure 4), guide students to clarify the connection between the two, and derive the parallelogram area formula.

After deduced the formula for calculating the area of the parallel sides, there must be some confusion in the mind: can all the parallelograms be converted into rectangles to count? In order to solve the confusion in students' hearts, students need to continue to explore by themselves. Therefore, activity 2: Solve the problem " Can all the parallelograms be converted into rectangles to count?"Students will definitely think in the opposite way and draw a variety of unusual parallelograms (Figure 5) to further verify whether the conclusion of the parallelogram into a rectangle is correct. By "multiple cuts", these unusual parallelograms can also be

"transformed from parallelograms to rectangles". In this challenging task "is all the parallelogram can be converted into a rectangle to count", the students, through the number, spell or move the parallelogram, into a rectangle, further make thinking, hypothesis, operation, understanding, expression organically, have a very intuitive "transformation". Activity 3: Provide four parallelograms with the same side length but different areas (Figure 5). Through observation and exploration, students can deeply understand the nature of the area from the perspective of change, so as to promote the cultivation of students' sense of quantity and the idea of penetration function.

Different levels of students experience inquiry process step by step, because of different thinking level and the concept of space, spell method and times are different, but solved the cognitive conflict and the doubts in the heart, understand the relationship between the parallelogram area and rectangular area, establish a sense, the development of space concept, realize the depth of inquiry and thinking.

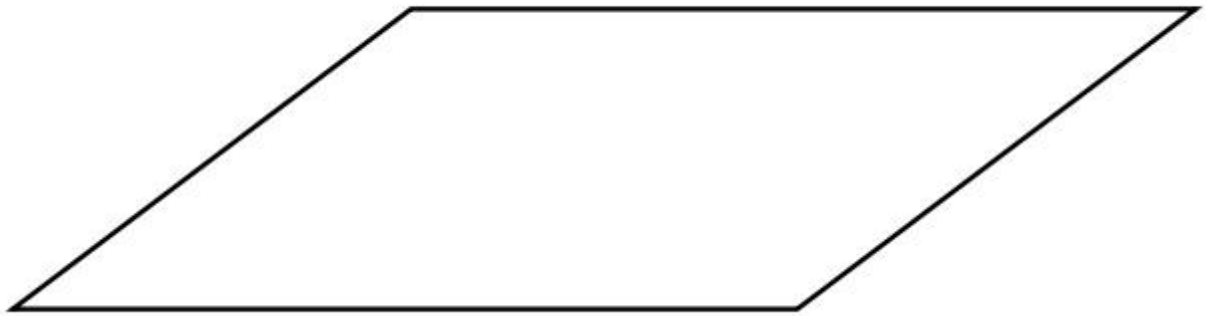

Figure 1

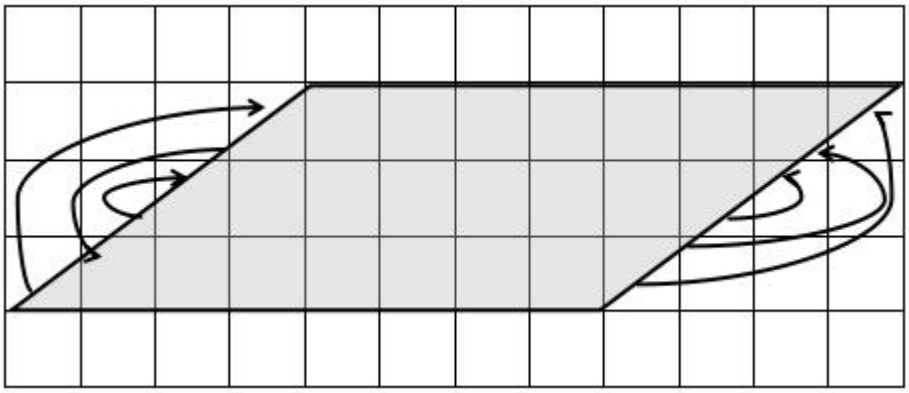

Figure 2

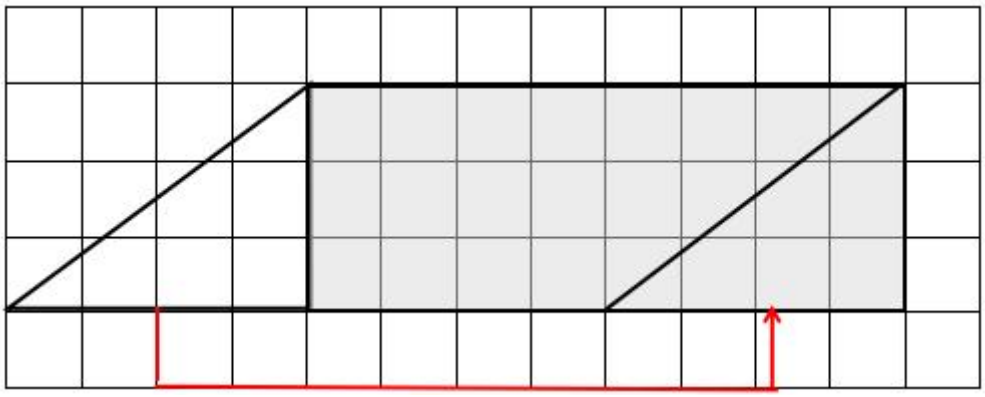

Figure 3

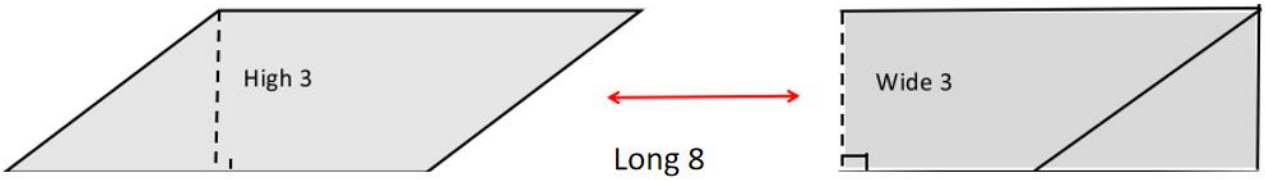

Figure 4

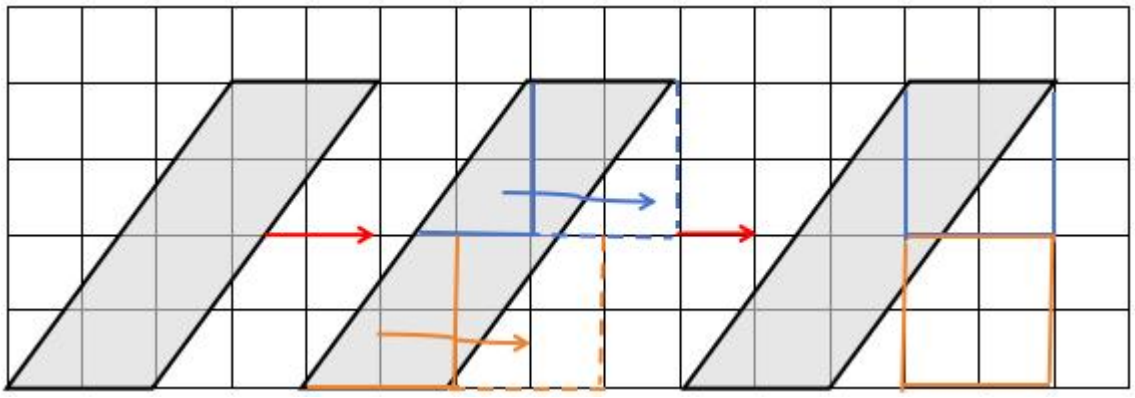

Figure 5

Figure 6

Highlight the essence of mathematical knowledge and permeate the mathematical thought method

The teaching design of primary school mathematics from the perspective of deep learning should emphasize the core essence of mathematics and the mathematical thinking methods. The essence of mathematics discipline not only reflects the unique difference between mathematics and other disciplines, but also is the cornerstone for students to explore the mathematical world deeply. In the process of teaching implementation, we need to accurately grasp the essence of mathematical knowledge and mathematical thought, guide students to understand the mathematical knowledge from the essential level, and master the mathematical thought method on the basis of understanding. In this way, students' thinking ability can be deepened and realize a true sense of deep learning. Taking the teaching of parallelogram area as an example, we should focus on the essential understanding of graphic measurement and transformation ideas, so as to help students build a solid mathematical foundation.

First of all, focus on the nature of mathematical knowledge, the students' thinking to the depths. In mathematical knowledge, simply put, the essence of measurement is the accumulation of units of measurement. Therefore, the "units" are extremely important. Taking "number squares"

as the key part of classroom teaching throughout, the process of "number squares" is the process of measuring the area of plane graphics by unit of area. This idea is designed for the essential attributes of the area. Students change from "dissatisfied with one space" to "spell the whole grid", and then to "number grid" and "calculation grid", which reflects the "unit quantity of the area", which is the basic principle of area calculation."Grid" is the local transformation of graphics, for the transformation of the graphics accumulated operation experience, students through the overall translation, the parallelogram into a rectangle, they found that the area unit quantity, namely "deformation", aware of the main purpose of transformation is easy to use per line by number to measure the area, essentially and has learned the area measurement is consistent with the: rectangular, square area unit to measure the specific value. In this way, it is easy to understand that the essence of the parallelogram area contains several area units, and then, the area formula of the parallelogram is derived, which further reflects the important position of the area unit in the area of the plane graph. The area of the graph is the result of the accumulation of the area units, which is the essence of the area.[2]It is such a basic principle that can communicate all of the plane graphic area. In this way, students' thinking will not stay on the surface of knowledge, but point to the understanding of the nature of mathematical knowledge.

Secondly, master the essence of the transformation ideas, and migrate the mathematical methods deeply. The application of mathematical thinking method helps students to recognize the essential connotation behind the form and make the knowledge have enough stability. This stable

cognitive structure helps students to better understand and apply new mathematical thinking methods in the process of deep learning, so as to realize the effective transfer and expansion of thinking methods. In order to enable students to deeply transfer their mathematical ideas to other situations, we need to guide them to understand the nature of transformation ideas and their application. Therefore, students should understand the transformation of ideas in essence, which requires students to connect "new knowledge" with "old knowledge", turn "new knowledge" into "old knowledge", and turn "unknown" into "known", so as to promote the exploration of new knowledge. Students transform the parallelogram into a rectangle. On the one hand, transform the "plane graph that cannot be directly measured" into "plane graph that can be directly measured", and more important is to understand the commonality of the two graphs at the level of "number". On the other hand, students need to experience the connection between the parallelogram and the transformed rectangle, which is the basis for deriving the area formula of the parallelogram. In the teaching process, subtly let students understand the nature of transformation thought, know the use of transformation ideas must be based on effective association, in other words, why the parallelogram into a rectangle rather than other graphics, because the area unit is square, area unit regularly arrangement must be composed of square combination of graphics, and rectangle is one of the most common. Such teaching is not only helpful to the current learning, but also lays a solid foundation for the subsequent exploration of the area calculation formula of triangle, trapezoid and circular figures, so that students can apply the transformation ideas in a wider field of mathematics.

Communicate the internal connection between the knowledge, and deepen the understanding of the core content

Reviewing the essence of mathematics, we can find that its knowledge system shows a strong correlation in terms of logic and systematization. In order to deepen students' understanding of the core content, deep learning teaching design emphasizes mining and explaining the internal connection between knowledge. Especially for those knowledge points that are easily confused, through analysis and comparison, students can more clearly grasp the differences and connections between them in communication, and then build a more systematic and complete mathematical knowledge structure.

First, communicate, and discover common attributes. In mathematics, we put special emphasis on the communication and connection between different knowledge points, especially the mathematical knowledge in the same neighborhood, to help students find their same essential properties. By guiding students to observe, analyze and compare, we can reveal the internal correlation and common characteristics of mathematical knowledge. Through this communication, students can not only better understand the essence of each knowledge point, but also learn to connect them, form a broader and deeper mathematical understanding, and promote the development of deep learning. This process of discovering the same attributes not only helps to improve students' mathematical literacy, but also cultivates their logical thinking and problem-solving ability. In activity 1, the teacher presents the students' works (as shown in Figure 3), and let the students observe the graphics and think about what they find. Through observation, to communicate the old knowledge that

"a rectangle is a special parallelogram", students experience in-depth thinking at two levels. First, the area before and after the transformation remains the same, and the length of the two vertical line segments in the graph can be multiplied to find the area of the plane graph. Secondly, it is found that the length of the rectangle is equivalent to the bottom of the parallelogram, and the height of the rectangle is equivalent to the height of the parallelogram. Therefore, "bottom" can be used to replace "long", and "high" can replace "wide". Finally, the calculation formula of graph area is essentially "bottom by high", which is consistent in the essence of area calculation.

Secondly, explore the problem, analyze and compare. In the third activity, the students found that the four parallelograms with the same side length had different areas, and then guided the students to fold the four parallelograms together (see Figure 4) to explore the truth, and the students had new thinking and discovery. First, the frame is pulled up, high increase, the bottom is unchanged, the area naturally with the high increase and larger. However, the area of the parallelogram cannot be infinite. When the frame is pulled into a long square, the two adjacent line segments are perpendicular to each other, that is, when the bottom and the height are vertical, the area is the largest. The second is found that the area of the parallelogram is related to the bottom and the height. According to the changing law of the product, students know that any amount of increase or decrease, the area will increase or decrease accordingly. Third, the side length of these parallelograms is the same, that is, the perimeter is equal, and the perimeter is unchanged, so the fundamental area change is because the height changes, and the bottom

has not changed. After repeated observation, thinking, analysis and comparison, communicating the internal connection between graphics, students deeply understand the nature of area from different angles, and promote the development of students' spatial concept and geometric intuition.

In summary, In the instructional design of deep learning, Teachers do a good job in the core content of the subject, highlight the nature of mathematics, communicate the internal connection of the three points, Let the students experience the cognitive processes such as "analysis, synthesis, abstract, generalization, analogy, comparison, transfer, analogy, reasoning", Let the teaching step out of the shallow level, To trigger students to think deeply, To develop students' advanced thinking, So that students can deeply understand the nature of mathematical knowledge and thinking methods, Actively transfer the thought method in the later study, Gradually translate it into a mathematical activity experience, Take the mind deep down, Make deep learning really happen in essence.

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