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Research on Assignment Design Based on the Core Competencies of Primary School Mathematics

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Abstract: *Driven by the concept of core competencies education, primary school mathematics assignment design has become an important way to cultivate students' comprehensive competencies. This study focuses on how to optimize the primary school mathematics assignment design according to the core competency requirements, in order to improve students' mathematics ability and comprehensive competency. The analysis shows that the traditional assignment design has the problems of simplicity and mechanization, which is difficult to effectively cultivate students' core competency. Therefore, this paper puts forward the principles of heuristic, personalized and hierarchical, interactive and autonomous assignment design, and expounds the design strategies of diversified assignment types, including practical, exploratory and expressive assignment, in order to stimulate students' interest in learning and cultivate their mathematical thinking, innovation ability and practical application ability. The implementation of these strategies will help to stimulate students' interest in mathematics, cultivate their innovative thinking and problem-solving ability, so as to lay the foundation for students' all-round development.*

Keywords: *Primary school mathematics; Core competencies; Assignment design; Design principles; Design strategies*

1. Introduction

Primary school mathematics education is the cornerstone of cultivating students' logical thinking ability, problem-solving ability and innovative spirit [1]. It not only provides students with the opportunity to learn and master the basic concepts and skills of mathematics, but also lays a foundation for students' future development in all aspects [2]. However, for a long time, the traditional mathematics assignment design pays too much attention to the simple teaching of knowledge and repeated practice of technology, and ignores the cultivation of mathematical thinking and students' core competency [3]. With the advancement of education reform, more and more educational concepts pay attention to the comprehensive development of students. Core competency education is widely accepted and implemented, which has brought profound changes in the design of primary school mathematics assignment [4].

Primary school mathematics assignment plays a vital role in students' learning process. Good assignment design can not only help students consolidate classroom knowledge, but also promote the diversity and depth of students' thinking mode. Through scientific assignment design, teachers can stimulate students' interest in learning, cultivate students' mathematical thinking, innovation ability and comprehensive ability to solve problems. Therefore, optimizing the design of primary school mathematics assignment, especially under the framework of core competency, not only helps to improve students' mathematical ability, but also helps to reduce the burden of schoolwork in terms of "quantity" and "quality", and effectively promote the growth of students' literacy [5].

This paper aims to explore how to design primary school mathematics assignment according to the requirements of core literacy, so as to improve students' mathematical ability and comprehensive competency. The core issues of the study include: 1) how to clarify the connection between the job objectives and core literacy; 2) how to design various types of assignment to meet the learning needs of different students and 3) how to promote students' continuous progress by optimizing the design of assignment.

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2. The relationship between the elaboration of the concept of core literacy and Mathematics Education

2.1 Definition of core competence

The mathematics curriculum standard for compulsory education issued by China in 2022 clearly states that mathematics teaching should focus on cultivating students' core competencies, including number sense, quantity sense, geometric intuition, reasoning consciousness, etc. The new curriculum standard emphasizes that the design of teaching materials should reflect the complete process of "knowledge background-knowledge formation-revealing connection", and help students understand the preciseness and logicality of mathematical knowledge.

2.2 The relationship between core literacy and Mathematics Teaching

As an important channel to cultivate students' core competency, mathematics teaching has unique advantages. Firstly, the logic and systematicness of mathematics can help students develop clear thinking framework and rigorous reasoning ability; Secondly, the application of mathematics enables students to find and solve problems in real life, and enhance their innovation and practical ability; Finally, mathematics, as a basic discipline, can provide students with interdisciplinary knowledge system and methods, and promote their all-round development. At the primary school stage, the core competency is manifested in the cultivation of mathematical thinking, the improvement of mathematical application ability and the stimulation of mathematical innovation consciousness.

3. The importance and problems of primary school mathematics assignment

3.1 Functions of the assignment

Assignment is not only the continuation of students' after-school learning, but also plays an important role in promoting knowledge consolidation, cultivating problem-solving ability and improving innovation consciousness. Through assignment, students can further understand the mathematical concepts learned in class, exercise their thinking and application ability, and then improve their ability to solve practical problems. Especially through flexible and diverse forms of assignment, students can apply mathematical knowledge in different situations and enhance their practical ability.

3.2 Common problems in assignment design

Although assignment plays a positive role in mathematics learning, there are some problems in primary school mathematics assignment design. The first is that the amount of assignment is too large, and students spend a long time completing a large number of repetitive assignment, lacking opportunities for in-depth thinking and exploration. Secondly, the form of assignment is single, mainly relying on standardized written exercises, which cannot effectively stimulate students' interest in learning. Finally, many assignments focus on the memory and practice of knowledge points, ignore the cultivation of mathematical thinking and the improvement of innovation ability, and fail to really implement the goal of core competency.

4. The principle of assignment design under the guidance of core competencies

4.1 Heuristic principle

The heuristic principle emphasizes that assignment design should have the function of stimulating students' thinking, and can guide students' active thinking and exploration. In the design of assignment, teachers should put forward open questions, encourage students to exert their imagination, and cultivate their innovative consciousness and critical thinking. At the same time, assignment should be combined with students' daily life, so that students can feel the application of mathematics in practical problems, so as to deepen the understanding and mastery of mathematical knowledge. In addition, assignment should be interesting, attract students to actively participate in learning activities, stimulate learning interest and curiosity, so as to be more active in learning.

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4.2 Principle of individuation and hierarchy

The principle of individuation and hierarchy requires that the design of assignment should fully consider the individual differences of students, and design differentiated tasks according to the learning progress and ability of different students. Teachers should provide multi-level assignment choices to enable students to think and explore in depth within the scope of their own challenges. At the same time, this design can also help students develop the ability of autonomous learning. For example, in the process of designing assignment, different methods and ideas can be provided to solve problems and broaden students' ideas, which helps to cultivate students' innovative thinking and problem-solving ability.

4.3 Principle of interactivity and autonomy

The principle of interactivity and autonomy requires that the design of assignment should promote the interaction and cooperation between students, and encourage students to actively apply their mathematical knowledge to the actual situation. In assignment design, teachers should encourage students to complete assignment in groups through task-based, project-based and other forms, which is helpful to cultivate students' group consciousness and cooperative spirit. Through group cooperation, students can explore problems from different perspectives and ideas to promote thinking collision, which will also help broaden students' vision and further improve students' innovation ability. Under the guidance of core literacy, primary school mathematics teaching pays more attention to the dominant position of students, and encourages students to actively participate in the learning process and become the master of learning. Autonomous assignment design can enable students to choose suitable assignment content and difficulty according to their own interests, abilities and needs, so as to increase students' learning enthusiasm and initiative. At the same time, autonomous assignment design can promote students' independent thinking and exploration, which is helpful to cultivate their ability to solve problems independently.

5. Core competency oriented primary school mathematics assignment design strategy

5.1 Clarify the connection between operation objectives and core literacy

In the actual design of assignment, teachers should always ensure that the goal of assignment is closely linked with the cultivation of students' core competency. The goal of each assignment should not only focus on the mastery of knowledge, but also on the improvement of students' mathematical thinking and innovation ability. The assignment objectives should be specific and clear, and effective feedback can be made through the evaluation system to help students find their own advantages and disadvantages.

5.2 Design of diversified operation types

Practical assignment: Students are required to apply the mathematics knowledge learned in class to real life, such as measuring the length of objects or calculating the area of household supplies. This kind of assignment is helpful to cultivate students' practical ability and enhance their awareness of transforming theoretical knowledge into practical ability.

Inquiry assignment: Inquiry assignment focuses on cultivating students' independent inquiry spirit and the ability to solve complex problems. When designing such assignments, teachers should ask challenging questions and encourage students to think and solve them from multiple perspectives. For example, let students explore the calculation methods under different denominators when learning the addition and subtraction of scores, or design relevant experiments when learning probability, so as to enhance students' inquiry learning experience.

Expressive assignment: Expressive assignment aims to improve students' mathematical expression and communication skills. Through oral expression, written expression and other forms, students can clearly express their understanding of mathematical concepts and improve their ability to explain problems in mathematical language. This kind of assignment is helpful for students to understand the close relationship between mathematics and real life in practical application.

5.3 Optimization of the assignment evaluation and feedback mechanism

Pay attention to process evaluation: process evaluation emphasizes students' performance in the

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learning process, rather than simply focusing on the results of assignment. Teachers should pay attention to students' thinking style, problem solving steps and innovation in the process of problem solving, provide feedback in time and guide students how to improve.

Provide personalized feedback: personalized feedback is the specific guidance given according to students' assignment performance. Teachers should put forward targeted opinions and suggestions according to the actual situation of each student to help students improve their learning methods and strategies.

6. Case analysis

6.1. Practical operation design

The intuitive cognition of the shape, size and position relationship of space objects or graphics is the concept of space. According to the abstract geometric graphics of the physical object, focusing on the geometric graphics to imagine the physical object, perceiving and imagining the movement and change laws of objects and graphics, all belong to the category of the concept of space.

Example 1 Please show the spatial layout of your living room in the form of a plan, measure the length, width and floor area of the living room, coffee table, TV cabinet and sofa, and record the data.

Analysis: In the process of completing this assignment, students not only need to use steel tape, tape and other tools to measure the length and width of the living room, coffee table, TV cabinet and sofa, but also need to observe the spatial relationship of the coffee table, TV cabinet and sofa. By completing this assignment, students can abstract the living room, coffee table, TV cabinet, sofa and other concrete things into a plane graph. In this plane graph, the position of the coffee table, TV cabinet, sofa in the living room is clearly visible. This not only helps to guide students to further understand, master, and use the calculation formula of polygon area, but also helps to develop students' spatial concept. In order to complete this assignment with high quality, students need to pay attention to it with mathematical vision

Through observation, students can not only clarify the position relationship between furniture, but also gradually form the consciousness, habit and ability to observe the real world with a mathematical vision.

6.2. Inquiry-based assignment design

Computational ability, reasoning consciousness or reasoning ability are the main forms of students' mathematical thinking in the compulsory education stage. Reasoning assignment is a kind of inquiry assignment designed by teachers around the teaching content and aimed at developing students' reasoning thinking. Students can not only closely connect the old and new knowledge, but also deduce "unknown" from "known" by completing this kind of assignment

Example 2 Please write the area calculation formula of trapezoid and rectangle, and try to deduce the area calculation formula of regular hexagon according to the area calculation formula of trapezoid and rectangle

Analysis: This is a reasoning assignment. Students are required to write the area calculation formula of trapezoid and rectangle. On the one hand, it aims to guide students to review, review and consolidate what they have learned and review their existing knowledge. On the other hand, it lays the foundation for the subsequent derivation of the area calculation formula of regular hexagon. What is the relationship between regular hexagon, trapezoid and rectangle? Students can make this clear by drawing two parallel diagonal lines on a regular hexagon: a regular hexagon is actually composed of two identical trapezoids and a rectangle. If the area of trapezoid and rectangle can be calculated respectively, the area of regular hexagon can be accurately obtained. The area calculation formulas of trapezoid and rectangle belong to the category of "known" knowledge, while the area calculation formulas of regular hexagon are "unknown" problems to be solved. Under the guidance of the reasoning assignment, students' cognition of regular hexagon can be expanded, and the internal relationship between regular hexagon, trapezoid and rectangle can be observed, and the area calculation formula of regular hexagon can be deduced through the reasoning process. In the process of completing this assignment, students have accumulated experience in reasoning polygon area calculation methods, and further mastered the calculation methods of polygon area. From "known" to "unknown", from "observation" to "reasoning", students' observation ability and reasoning thinking can be developed and improved in this assignment.

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6.3. Expressive assignment design

Mathematical concept is a quantitative relationship or spatial form expressed in written language. Written language is the medium to express mathematical concept. When learning "cylinder and cone", teachers require students to choose their own fields of interest to calculate and express the results in mathematical language. This assignment not only promotes students' mathematical understanding, but also improves their communication skills.

Example 3 Requires students to work in groups to find and record the application examples of cylinders and cones in life (such as beverage bottles, street lamp columns, ice cream, etc.), and discuss the mathematical principles of these examples in groups, such as why these objects are designed in the shape of cylinders or cones, and what are the advantages of such a design.

Analysis: This is a practical and exploratory assignment. In the form of group cooperation, it aims to cultivate students' team cooperation and communication ability, and guide students to closely link mathematics knowledge with life practice. In the process of looking for life examples, students can deeply observe and experience the extensive application of mathematics in the real world. Through the discussion of cylindrical and conical objects, the mathematical principle behind them is explored in depth. For example, the design principle of cylindrical beverage bottles is that the cylinders have the same radius, which makes the beverage bottles bear pressure evenly in all directions, and under the same material consumption, the cylindrical volume is relatively large, which can effectively reduce the production cost; The conical shape of ice cream, on the one hand, the conical shape can provide a gradually retracted support for ice cream to prevent ice cream from sliding easily, on the other hand, the conical surface area is relatively small, which can reduce the contact area between ice cream and air to a certain extent and delay the melting speed.

In the group discussion, students express their opinions and inspire each other, so that they can more comprehensively and deeply understand the advantages of cylinder and cone shape in practical application, which not only deepens the understanding of the geometric properties of cylinder and cone, but also improves the students' ability to use mathematical knowledge to explain life phenomena and solve practical problems, realizes the transfer of mathematical knowledge from theory to practice, enables students to deepen mathematical cognition and enhance mathematical literacy in practical exploration.

7. Conclusions

Primary school mathematics assignment design plays an irreplaceable role in cultivating students' core competency. The research clearly points out that the traditional assignment design has the problems of simplicity and mechanization, which is difficult to meet the needs of students' core literacy development. Through the in-depth discussion on the concept of core literacy education, this paper puts forward the principles of assignment design, such as enlightening, personalized and hierarchical, interactive and autonomous, which provides theoretical basis and practical guidance for primary school mathematics assignment design. The implementation of diversified assignment design strategies, including practical, exploratory and expressive tasks, provides students with varied learning opportunities, helps to stimulate their interest in learning, and cultivates their mathematical thinking, innovation capabilities, and practical skills. Although primary school mathematics assignment design still faces many challenges at this stage, such as the lack of teachers' design ability and resources, it is expected to effectively solve these problems by strengthening teacher training, enriching teaching resources and promoting home school cooperation. In the future, with the continuous deepening of education reform and the rapid development of information technology, primary school mathematics assignment design will develop in a more diversified, personalized and intelligent direction, further help students' core competency, and lay a solid foundation for students' comprehensive development.

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