

Problems and Solutions of Blackboard Writing Design in Teaching Skills Training of Primary Mathematics

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Abstract: Blackboard design is called "micro-lesson plan", which is also an indispensable teaching means. Blackboard writing design is an important teaching skill for normal students majoring in primary school education. By observing and recording the teaching skills training process of normal school students, this paper summarizes the problems existing in the design of primary school mathematics blackboard writing of normal school students from the perspective of science, standardization and planning, and analyzes the causes of the problems. At last, the author puts forward some strategies to solve the problems in the design of blackboard writing in primary school mathematics. These strategies include systematic learning of blackboard design knowledge, strengthening and improving the basic skills training, refining the content of blackboard writing, highlighting the important and difficult points of teaching, paying attention to cooperate with the explanation, and presenting blackboard writing in a timely manner.

Keywords: primary mathematics, teaching skills, blackboard writing design

1. Introduction

Blackboard writing skills are a type of teaching behavior in which teachers use text, symbols, and images on a blackboard or slide to present teaching content and thought processes to students, thereby generalizing and systemizing knowledge, helping students understand correctly, enhancing memory, and improving teaching efficiency. Proper organization of blackboard writing can inspire and guide elementary school students' mathematical thinking and serve as a good example. [1] The teacher's blackboard writing and mathematical language are both exemplary. Every action of the teacher during the blackboard writing process gives students a visual image in space (such as direction, position, speed, amplitude, order, pause, change, etc.), and elementary students are always imitating during the class. Whether the teacher is writing text, mathematical symbols, or drawing, they must be standard, correct, and error-free, otherwise it will leave a permanent erroneous impression on the students and affect their cognitive learning of mathematics. As future educators, the design of blackboard writing for primary mathematics classrooms is an important teaching skill for student teachers majoring in elementary education.

2. Problems Existing in the Design of Primary Mathematics Blackboard Writing

2.1. Errors in the stroke order of writing numbers

Some student teachers write the numbers "0" and "8" clockwise, causing the overall shape of the numbers to deform, and even to open. The stroke order for these two numbers in elementary textbooks is clearly defined as counterclockwise and closed. According to the survey, the reason for such erroneous writing by student teachers is the habit formed by imitating the blackboard writing of their primary mathematics teachers. This further illustrates the importance of the exemplary role of teacher blackboard writing.

2.2. Non-standard writing of mathematical symbols

Some student teachers write fractions by first writing the numerator, then the fraction line, and finally the denominator. The correct mathematical order should be to first write the fraction line, then the denominator, and finally the numerator. Actually, this order of writing aligns with the meaning of

fractions: the fraction line represents averaging unit "1", the denominator indicates the division into several parts, and the numerator represents one or several parts of these.

The decimal point is a small dot, which student teachers often mistakenly write as the pause sign ",", during the hurried process of blackboard writing. The equal sign "=" consists of two parallel lines of equal length. The fraction line, and the horizontal line in the vertical multiplication and division, should be horizontal and vertical, but student teachers often write them in a twisted and disorderly manner.

Additionally, when enumerating numbers in mathematics, we generally use a comma "," not the pause sign ",". In mathematics, the symbol for omission is usually "..." while in division with a remainder, "....." is used to indicate the leftover part. Student teachers often get confused about these symbols.

2.3. Inadequate Chinese Character Writing

In elementary school math classes, the blackboard writing not only involves mathematical symbols and shapes, but also Chinese characters. Some student teachers often make stroke order errors during the writing process. For example, for the Chinese character "方", some student teachers write the "slant" stroke before the "horizontal, fold, and hook" stroke, while the correct stroke order should start with "horizontal, fold, and hook". Although the Chinese character itself is not written incorrectly, the process of writing it on the blackboard will be seen by the primary school students and it will inevitably affect their learning of Chinese characters and language.

The Chinese characters written on the blackboard should be in regular script and should not be connected. Some student teachers indeed have a weak foundation in writing Chinese characters, resulting in ugly blackboard writing. There are also student teachers who have good handwriting skills when it comes to pen writing, but they are not accustomed to writing while standing in front of the blackboard. It often results in a significant difference between a student teacher's pen writing and blackboard writing.

2.4. Inadequate Diagram Drawing

Math classes require the correct use of drawing tools like triangles and compasses to accurately create common 2D and 3D shapes found in primary school math textbooks. This must be done with strict standards. For instance, when teaching the lesson "Understanding Segments, Rays, and Lines," student teachers often incorrectly extend one or both ends of a line segment to create rays or lines, and erroneously use dotted lines for the extensions. Dotted lines are generally used to represent auxiliary lines or lines invisible in a 3D shape from a certain angle. For example, when drawing a rectangular prism on the blackboard, some student teachers draw it haphazardly, with non-parallel edges, not conforming to the oblique two-measurement drawing method (the right angle on the side should be drawn at 45 degrees).

2.5. Arbitrary Blackboard Writing Design

Blackboard layout refers to the spatial arrangement and rational configuration of each part of the blackboard writing. Some student teachers are too casual with their blackboard writing, resulting in a lack of structure, chaotic layout, and a failure to highlight teaching key points and difficulties. For example, in a third-grade lesson on "Decimal Notation", the information and situational diagrams in the blackboard writing take up the main position, while the column calculation - which should be the teaching focus - is not conspicuous. Above the column calculation, the length units "meter" and "decimeter" are not clearly marked. This overlooks that third-grade students are in the preliminary stage of understanding decimals and need to use specific units to understand addition and subtraction. Additionally, the practice problems lack column calculation processes, the equations lack results, and units are missing.

3. Analysis of the Causes of Problems in Primary Mathematics Blackboard Writing Design

3.1. Weak Awareness of Blackboard Writing Design

Student teachers often don't pay much attention to blackboard writing design, relying more on multimedia presentations. They believe that PowerPoint slides can fully demonstrate the teaching

content, and blackboard writing is merely a formality, optional, and not worth spending too much effort designing. This attitude overlooks the standardization of teaching blackboard writing and often results in treating the blackboard as scratch paper, writing carelessly and erasing on a whim.

3.2. Inadequate Fundamental Training

The everyday blackboard writing practice of student teachers involves practicing Chinese characters, English words, simple sketches, mathematical symbols, and shapes on a small blackboard. These exercises allow for continuous revisions and slow writing. Although such training may look good in the final display, the limited size of the blackboard and unrestricted time make student teachers write slowly when using the lecture blackboard, taking up a significant portion of teaching time. Qualifications for teacher certificates and teacher interview simulations usually involve mock teaching, which only allows for blackboard writing. This is very different from daily basic skill training on a small blackboard. When asked to complete a demonstration lecture within a few minutes, student teachers often write hastily and non-standardly to speed up the blackboard writing process.

3.3. Inadequate Comprehension of Textbook Content

A good blackboard writing design should accurately depict the teaching objectives identified through curriculum interpretation, textbook analysis, and student situation analysis. It should precisely represent teaching blackboard writing in each step of the teaching implementation process. Student teachers often don't thoroughly study the textbook content, so they don't grasp the teaching key points and difficulties, the logical relationships between the knowledge points, which may lead to a chaotic presentation of knowledge in the blackboard writing, lacking standardization and scientific nature.

For example, when teaching the lesson "Two-Digit Multiplication (No Carryover)", some student teachers start writing the product of two steps in column arithmetic from the high digit, while column addition should start from the low digit. Although it doesn't affect the calculation result where to start adding in this problem, when there is a carryover in the lower digit, if starting from the high digit, the number of the previous digit will have to be changed. Therefore, it's more reasonable to start from the low digit.

4. Solutions to Problems in primary mathematics Blackboard Design

4.1. Systematic Learning of Blackboard Design Knowledge

Good blackboard design is about understanding its theory and applying its principles. Student teachers should systematically learn the theoretical knowledge of blackboard design, grasp the functions and principles of blackboard design, the structural layout of blackboard design, and the types of blackboard design. In primary mathematics classes, the blackboard is generally divided into the main and auxiliary blackboard areas. The main blackboard area is in the middle position, used to write topics and important examples, conclusions, and other significant content. The areas on both sides serve as auxiliary blackboards, which can be used for introductory or practice content, and also for calculations and other content that can be erased at any time.

Student teachers can also collect and read monographs or journal articles on primary mathematics blackboard design in their spare time, and watch excellent teachers' classroom teaching videos to deepen their understanding of theoretical knowledge.

4.2. Strengthen and Improve Basic Training in Blackboard Writing Skills

Student teachers should improve their daily training methods for basic skills, and reinforce the practice of writing with chalk on the podium. Firstly, they need to master the grip of chalk and the posture of writing. When writing on the board, they should ensure not to block the students' sightline. The writing speed should not be too slow to affect the teaching process, nor too sloppy. Secondly, they need to standardize the writing of text, mathematical symbols, and figures. The strokes of written words should be clear, without joining the strokes, correct in stroke order, neat in typeface, free of typographical errors, and correct in using punctuation marks, with attention paid to the overall effect. The writing of mathematical symbols needs to be even more standardized, with correct format and even layout. Mathematical figures, also an essential part of mathematical blackboard writing, should be

drawn correctly using the drawing tools, and the size of the figures should be appropriate, with some schematic diagrams and rough sketches on the blackboard also artistically pleasing.

4.3. Refine Blackboard Content, Highlight Key and Difficult Points in Teaching

For the training of student teachers' teaching skills, it is usually a ten-minute simulated class, mainly in the form of blackboard writing, with high demands for teaching density and compactness. Besides not being too slow in writing, they are also required to reflect the main content of teaching with the most refined literature or clear and concise figures and symbols, and the arrangement and layout of each part of the content are reasonable. For example, in the design of blackboard writing of operation formulas, the text of mathematical information and mathematical problems should align with the formulas. The operation method should be written below the formula. If there is enough time, the answer can be written below the operation method. If time is limited, the answer can be orally stated. One should not write only the word "answer" without writing the answer sentence.

Primary school students are often captivated by visually impactful elements. Therefore, trainee teachers can utilize colored chalk for blackboard instruction when explaining crucial concepts. This approach can help students form strong memories and thus grasp the key points effectively. For instance, in the case of column calculations where carryovers are involved, or where right angle symbols in plane figures are being taught, colored chalk can be used for notation.

To address difficult areas in teaching, a board drawing style of blackboard design can be employed. This involves using simple plane figures to stimulate students' understanding of the mathematics concepts being taught. For example, during the lesson on "Addition and Subtraction with Unlike Denominators", in order to help students understand why fractions with different denominators need to be converted into fractions with the same denominator before performing calculations, a graphic representation of the fractions is designed on the blackboard. This visually intuitive representation allows students to see clearly that the "size of each part" in these fractions is different, and they cannot be directly added. However, after finding a common denominator, the "size of each part" becomes the same, meaning the units of the fractions are the same, and they can be directly added.

4.4. Present Blackboard Work in a Timely Manner in Coordination with Explanation

Professor Fu Hailun believes that blackboard work should be presented in two forms - the process of writing and the presentation of blackboard work - both dynamic and static. Understood statically, blackboard work is merely the text or symbols that a teacher writes on the board in class, a tool to help students understand the concepts. However, viewed dynamically, blackboard work is a dynamic process that helps students think and guides them to internalize new content into their own knowledge system.[2] From this, it can be seen that classroom blackboard work is crucial for enhancing primary students' mathematical thinking. In addition to designing the blackboard work for the overall teaching content, trainee teachers also need to grasp the right timing for presenting blackboard work, plan the order of blackboard presentation according to teaching needs, and effectively combine the timing of blackboard work with explanations. The aim is to make blackboard work serve teaching better and thus enhance the level of mathematical thinking in primary students.

Table 1: Specific links presented by the blackboard.

Verbatim transcript	Blackboard writing and gesture
See how long 0.1 meter are? This is a one-meter-long ruler. Can you find 0.1 meter? You think 0.1 meter is 1 decimeter, and then where is 1 decimeter? Divide one meter into 10 parts, and take one of them as 1 decimeter, which is 0.1 meter. Do you agree? Let's see again that a decimeter is one-tenth of a meter, which is expressed as a fraction of 1/10 meter. What is the relationship between 1/10 meter and 0.1 meter? They are all equal to one decimeter. So 0.1 meter is 1/10 meter, and 1/10 meter is 0.1 meter.	Write "0.1 meters" on the blackboard Draw a 1 meter long line segment Write "1 decimeter =0.1 meter" on the blackboard Draw 10 equal parts on a 1 meter long line segment Write "1/10" meter on the blackboard and connect 1 decimeter with "=" Gesture along the two "=" Gesture refers to 1/10 meter and 0.1 meter

For instance, in the lesson "Preliminary Understanding of Decimals," the concept of 0.1 meter is introduced through the blackboard work design of "triangular relationship equations" with the help of a meter ruler. The specific segment for presenting the blackboard work is marked in the teaching process

design (as in Table 1). By questioning while presenting the blackboard work, students are guided to understand the close relationship among integers, fractions, and decimals during this logical reasoning process, thus deepening their understanding of one-decimal place numbers.

4.5. Organizing Blackboard Work Design Exchange Activities

In addition to "three pens and one drawing," the ability to design blackboard work should also be valued as a specialized skill among trainee teachers. Blackboard design requires flexible use of formats according to the teaching content, with clear logic and reasonable layout. This presents a certain challenge to trainee teachers and cannot be accomplished in a short time. In their daily study of primary school mathematics teaching skills, trainee teachers can form small groups to collaborate, collect materials for selected lessons, discuss and exchange design ideas; evaluate the blackboard designs used in their mock teaching sessions, learn from each other's strengths; and make supplementary revisions to their blackboard designs based on suggestions, eventually forming a satisfactory blackboard design.

For example, when designing a lesson on "solving equations," trainee teachers can compare and exchange ideas in small groups. The final blackboard layout may feature the properties of equations in the middle, with two equations presented below. This design effectively illustrates the use of equation properties to solve equations. The layout is clear and well-structured, with the solution process for both problems neatly aligned. Key knowledge is highlighted with colored chalk, presenting an overall coordinated, symmetrical, and aesthetically pleasing effect.

5. Conclusion

In summary, the design of blackboard work in primary school mathematics acts as a "bridge" that connects teachers, students, and textbooks, a "micro-teaching plan" for teaching implementation, and a comprehensive reflection of the teaching skills and mathematical literacy of trainee teachers. Teacher training institutions could organize blackboard work design competitions for primary school mathematics to motivate trainee teachers and cultivate their design innovation capabilities.

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References

- [1] Liu Juanjuan. *Primary School Mathematics Teaching Skills [M]*. Shanghai: East China Normal University Press. 2011: 175
- [2] Ma Cailan. *Research on the Design of Primary School Mathematics Blackboard under the Condition of Information Technology [D]*. Wuhan: Central China Normal University, 2021.