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DEVELOPMENT OF ELEMENTARY MATHEMATICS USING CONCRETE TEACHING AIDS ON FRACTION ADDITION OPERATIONS FOR GRADE V STUDENTS

Dul Azis, Takyun, Fahrudin
Universitas PGRI Semarang
azies.milah@gmail.com

ABSTRACT

Mathematics learning on fraction addition in elementary schools still demonstrates low levels of students' conceptual understanding. This condition is largely caused by the abstract nature of fraction concepts and the limited use of concrete learning media in classroom instruction. This study aims to develop and implement a concrete teaching aid known as the *Rainbow Board* to support the teaching of fraction addition for fifth-grade elementary school students. The research employed an instructional development method consisting of five stages: analysis, design, development, implementation, and evaluation. The implementation was conducted with fifth-grade students of SDN Cintamanik 02 through group-based learning activities that utilized colored fraction pieces as visual representations of fraction addition concepts.

The results of the study indicate that the use of the Rainbow Board had a positive impact on students' conceptual understanding and learning outcomes. The average student score increased from 63.85 before the use of the teaching aid to 81.15 after its implementation. These findings demonstrate that the Rainbow Board is effective in transforming abstract fraction addition concepts into concrete and meaningful learning experiences, thereby enhancing students' understanding in elementary mathematics learning.

Keywords: concrete teaching aids; rainbow board; fraction addition; elementary mathematics

INTRODUCTION

Mathematics learning in elementary school plays a crucial role in developing students' logical, systematic, and critical thinking skills. One of the fundamental topics in elementary mathematics is fractions, particularly fraction addition operations. Mastery of fraction concepts is essential because it serves as a prerequisite for understanding more advanced

mathematical topics at higher educational levels. However, various learning outcomes indicate that fractions remain one of the most challenging topics for elementary school students.

Students' difficulties in understanding fraction addition are generally caused by the abstract nature of the material and instructional practices that emphasize symbolic manipulation and procedural steps without sufficient support from concrete representations. As a result, students tend to memorize algorithms without truly understanding the underlying concepts. This condition leads to low conceptual understanding and unsatisfactory learning outcomes. According to Piaget's theory of cognitive development, elementary school students are in the concrete operational stage, meaning that they learn most effectively through direct interaction with tangible objects. Therefore, mathematics instruction should involve concrete learning experiences that allow students to manipulate physical objects in order to construct mathematical understanding. The use of concrete teaching aids can help students bridge the gap between concrete experiences and abstract mathematical symbols.

One concrete teaching aid that can be used in fraction learning is the *Rainbow Board*, a learning medium consisting of a board and colored fraction pieces representing specific fractional values. This teaching aid enables students to visualize equivalent fractions, equalize denominators, and combine fractional parts directly. The Rainbow Board is expected to reduce the level of abstraction in fraction addition learning and to increase students' active participation and conceptual understanding.

Based on these considerations, this study aims to develop and implement the Rainbow Board as a concrete teaching aid in elementary mathematics learning on fraction addition for Grade V students, as well as to examine its effectiveness in improving students' conceptual understanding and learning outcomes.

RESEARCH METHOD

This study employed an instructional development research method aimed at producing and implementing a concrete teaching aid, namely the Rainbow Board, for fraction addition learning in elementary school. The development procedure was adapted into five stages: analysis, design, development, implementation, and evaluation.

The analysis stage was conducted to identify learning problems related to fraction addition in Grade V at SDN Cintamanik 02, particularly students' low conceptual understanding

resulting from abstract instruction and minimal use of concrete learning media. The findings from this stage served as the basis for determining the need for developing a concrete teaching aid.

The design stage focused on planning the structure of the Rainbow Board and designing learning activities that support fraction addition instruction. The instructional design considered the characteristics of elementary school students in the concrete operational stage and emphasized collaborative learning and visual fraction representations.

The development stage involved constructing the Rainbow Board, which consists of a board and colored fraction pieces with specific fractional values, as well as developing student worksheets to guide learning activities. All instructional materials were aligned with the learning objectives and basic competencies for Grade V fraction addition.

The implementation stage was carried out by applying the Rainbow Board in mathematics learning activities for Grade V students at SDN Cintamanik 02. Learning was conducted in small groups, where students used fraction pieces to equalize denominators and determine the results of fraction addition through direct manipulation and visualization.

The evaluation stage aimed to assess the effectiveness of the Rainbow Board in improving students' learning outcomes. Evaluation was conducted by comparing students' achievement scores before and after the implementation of the teaching aid. The data were analyzed using descriptive quantitative analysis to determine changes in average student performance.

RESULTS AND DISCUSSION

Research Results

The implementation of the Rainbow Board as a concrete teaching aid was conducted during mathematics learning on fraction addition in Grade V at SDN Cintamanik 02. Learning activities were organized in group-based formats to encourage interaction, discussion, and collaborative problem-solving among students. Each group was provided with a set of Rainbow Board materials consisting of a board and various colored fraction pieces.

At the initial stage of learning, the teacher presented contextual problems related to fraction addition with different denominators. Observations indicated that many students experienced difficulties in determining appropriate solution steps. Students tended to add numerators and denominators directly without equalizing denominators, reflecting a lack of conceptual understanding.

After the Rainbow Board was introduced, students demonstrated noticeable improvements in their understanding of fraction addition. Students were able to select fraction pieces corresponding to the given problems and arrange them on the board to visually compare fractional sizes. Through this activity, students realized that fractions with different denominators cannot be added directly and must first be converted into equivalent fractions. The process of equalizing denominators was conducted by replacing larger fraction pieces with multiple smaller pieces of equivalent value. This activity helped students understand the concept of equivalent fractions concretely and visually. Once denominators were equalized, students combined the fraction pieces to determine the sum, reinforcing the idea of fraction addition as the combination of parts of a whole.

Evaluation results showed a significant improvement in students' learning outcomes. Prior to using the Rainbow Board, the average student score was 63.85, indicating that many students had not yet achieved mastery. After the implementation of the teaching aid, the average score increased to 81.15, demonstrating improved conceptual understanding and learning achievement.

Discussion

The improvement in students' learning outcomes following the use of the Rainbow Board confirms the importance of concrete teaching aids in elementary mathematics instruction, particularly for abstract topics such as fraction addition. The Rainbow Board transformed abstract fraction concepts into tangible learning experiences through visual and manipulative representations.

These findings support Piaget's cognitive development theory, which emphasizes that elementary school students learn best through concrete experiences. By allowing students to manipulate fraction pieces directly, the Rainbow Board facilitated meaningful concept construction and reduced cognitive barriers associated with abstract symbols.

Furthermore, the use of the Rainbow Board encouraged active student participation in the learning process. Students were not passive recipients of information but actively engaged in discovering mathematical concepts through exploration, discussion, and collaboration. This active involvement contributed to increased learning motivation and confidence in solving mathematical problems.

The results of this study are consistent with previous research indicating that concrete and manipulative learning media enhance students' conceptual understanding of fractions. Such

media help students connect concrete representations with symbolic forms, supporting a smoother transition from concrete understanding to abstract reasoning.

Thus, the Rainbow Board functions not only as a teaching aid but also as a strategic instructional tool for improving conceptual understanding, learning outcomes, and student-centered mathematics learning in elementary schools.

Conclusion

Based on the research findings and discussion, it can be concluded that the use of the Rainbow Board as a concrete teaching aid in fraction addition learning for Grade V elementary students is effective in improving students' conceptual understanding and learning outcomes. The Rainbow Board successfully bridges abstract fraction concepts into concrete, visual, and manipulable learning experiences.

The implementation of the Rainbow Board provided students with direct learning experiences in equalizing denominators, recognizing equivalent fractions, and combining fractional parts to obtain correct results. Group-based and manipulative learning activities increased student engagement, motivation, and meaningful understanding.

The evaluation results showed a significant improvement in student achievement, with the average score increasing from 63.85 to 81.15 after the use of the Rainbow Board. These findings reinforce the suitability of concrete teaching aids for elementary students who are in the concrete operational stage of cognitive development.

Suggestions

Teachers are encouraged to integrate concrete teaching aids such as the Rainbow Board into mathematics instruction, particularly for topics with high levels of abstraction. The use of concrete media can help students develop deeper conceptual understanding rather than relying solely on procedural memorization.

Schools are expected to support the development and provision of various mathematics teaching aids to promote contextual, active, and meaningful learning. Future research is recommended to further develop and test the Rainbow Board in other mathematical topics or grade levels to obtain more comprehensive results.

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