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Fraction Board Design to Stimulate the Elementary School Students' Critical Thinking Ability Regarding Fraction

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Abstract: This research is motivated by the limited use of mathematics learning media, especially in elementary schools, which can facilitate students' physical activity in building knowledge. This research aims to produce a product in the form of a fraction board that is feasible and has a good impact on the critical thinking skills of elementary school students. The type of research is RnD with the Pomp model. The test subjects in class IV SD N 31 Jati Tanah Tinggi consisted of 30 students. Data collection techniques use questionnaires, interviews and tests. The research results show that fraction board media is suitable for use with very valid criteria. Fraction board media is also easy to use and can train elementary school students' critical thinking skills.

Keywords: Elementary School; Critical Thinking; Fraction Board; Stimulate

Introduction

In the era of globalization and advances in information technology, critical thinking skills have become one of the key competencies that every individual must have (AlJaafil & Sahin, 2019). This is not only important for competing in the world of work, but also essential in everyday life for making the right decisions (Hernandez-de-Menendez et al., 2020). Realizing the importance of this competency, basic education has a crucial role in laying the foundation for critical thinking skills in students (Puspita & Dewi, 2021).

Critical thinking skills in elementary school are the foundation for healthy intellectual development and strong thinking abilities throughout life (Cáceres et al., 2020; Darling-Hammond & Oakes, 2021). In the elementary school learning environment, students learn to analyze information, formulate relevant questions, and make decisions supported by evidence. Critical thinking skills enable students to understand concepts better, solve complex problems, and be active in learning (Ramdani et al., 2021). It also helps students develop effective speaking and writing skills, preparing them for a future full of challenges and opportunities (Nirmala, 2019; Tang et al., 2020). Thus, practicing critical thinking in elementary school not only builds a strong academic foundation, but also equips students with intellectual abilities that are important in everyday life and in the world of work (Kennedy & Sundberg, 2020).

Critical thinking skills are the ability to analyze information or situations objectively, consider various points of view, and make decisions or conclusions based on evidence (Guljakhon & Shakhodat, 2020; Renatovna & Renatovna, 2021). In the context of fractions, these skills include the ability to understand concepts, compare and order fractions, and solve problems related to fractions (Wiratman et al., 2023). Thus, media that can support the development of these skills is certainly needed.

One area of learning that is often considered complex material by elementary school students is

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mathematical concepts, especially fractions (Hariyani et al., 2022). Fractions are a topic that requires conceptual understanding and logical thinking skills. To understand fractions, students need to be able to visualize, compare, and manipulate these concepts. Unfortunately, textbooks and traditional teaching methods are often not effective enough in teaching these concepts in depth.

Fraction board media in elementary schools has long been known as an effective tool in teaching the concept of fractions (Desrina, 2022). This media allows students to physically see and feel fractions, making mathematical abstractions more concrete (Liza, 2022; Rohmah et al., 2022). Previous research on the use of media in teaching mathematics shows that concrete media, such as fraction boards, can improve students' conceptual understanding.

On the other hand, basic education curricula in many countries, including Indonesia, increasingly emphasize the importance of developing critical thinking skills (Jayadiputra et al., 2020; Prayogi & Verawati, 2020). This shows an urgent need to research and develop teaching media that not only improve understanding of the material, but also students' critical thinking skills. Based on this reasons, it is very important to conduct research on fraction board media in the context of critical thinking skills training for elementary school students. The main question that arises is: How can fraction board media be developed and integrated into the learning process to maximize the critical thinking skills training of elementary school students?

In addition, understanding the best way to implement this media in the classroom, as well as training for teachers in using this media is also crucial. This is important so that teachers can facilitate deeper learning and improve students' critical thinking skills effectively. In this context, research regarding the development and application of fraction board media in elementary schools becomes very relevant and urgent. It is hoped that this research can make a significant contribution to the development of more effective mathematics teaching methods, as well as support educational efforts in forming a critical and intelligent generation.

Improving primary school students' critical thinking skills, especially in fraction material, is a challenge and urgent need in education today (Waruwu & Warasi, 2023). Fraction board media has the potential to be an effective tool in achieving this goal. However, more research is needed to understand and optimize its use. Thus, research regarding the development of fraction board media is very important and relevant in efforts to improve the quality of mathematics education in elementary schools.

Method

This research is R&D research, namely research by developing or producing a product in the form of fraction board media (Hariati, 2022). Development research is a systematic study through the stages of designing, developing a product such as a program, model, teaching materials, teaching and learning strategies (Jennings et al., 1998), materials, media and others with the aim of producing solutions to answer complex problems that occur (Mardhiyana & Jailani, 2017).

This development model follows the process in development research. Starting with needs analysis, prototype development, prototype evaluation and revision through cycles until producing the desired product (Listiawan, 2016; Rahmah, 2020). The following are the steps for approaching development research design.

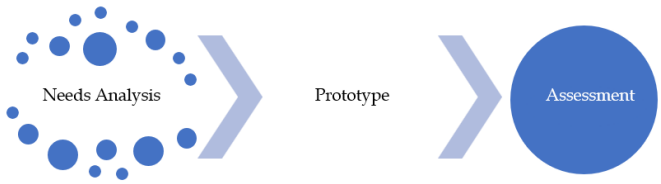

Figure 1. Plomp 2010 Development Cycle

Development research involves a series of steps that include needs analysis, literature review, conceptual framework development, prototyping, evaluation, and assessment (Al Haddar et al., 2023; Mesra, 2023). The initial stage involves a needs analysis to understand the need and relevant content. Then, a literature review was carried out to understand the research context. After that, a conceptual framework or theoretical framework is developed. The next stage is the creation of a product or intervention prototype, which is then evaluated for improvement. Finally, the assessment stage involves a summative evaluation to determine whether the product meets specifications or needs further improvement (Ejichukwu, 2023).

The procedure in this research, referring to the opinion above, is carried out systematically, namely needs analysis, prototype design, evaluation, and prototype revision to produce a valid, effective, practical product that can increase activity, creativity and develop students' mathematical abilities. Validity testing activities are carried out in the form of filling out a validation sheet containing questions and statements, and discussions until a condition is reached where the validator believes that the model developed is valid and suitable for application (Herlanti, 2023). The practicality of a learning model can be determined from its practicality, ease of use and understanding by filling out

a practicality questionnaire. Effectiveness is seen from increasing motivation, activity, productivity through observation sheets and learning results as well as the development of students' critical thinking abilities obtained through tests. The research procedure can be seen in the following diagram.

Result and Discussion

The first step taken is a preliminary analysis. Initial study results show that curriculum analysis shows that the fraction board is in accordance with the applicable curriculum and supports the desired learning outcomes, especially in addition of fractions material. Elementary school students, especially grade 4, are generally at the concrete operational cognitive development stage according to Piaget (Agustyaningrum et al., 2022). Therefore, the fraction board as a learning medium is designed by considering students' cognitive abilities at this stage, such as understanding concepts through direct experience and object manipulation (Rohmah et al., 2022). The use of a fraction board takes into account the student's motor skills, including size, shape, and manipulation of components. A fraction board that can be operated easily by students will help in understanding the concept of fractions more effectively. The use of fraction boards provides an opportunity for students to work together in groups. The results of the analysis are then used as consideration in designing the fraction board

Prototype results: rectangular shaped board, made from safe and durable material, namely wood. Fraction boards have parts that students can take apart and put back together to present different fractions. Equipped with clear labels or instructions, to help students understand how to use it. accompanied by separate instructions for using the fraction board provided to support teachers and students in using the fraction board effectively. Next, expert validity data regarding the fraction board is presented.

Based on the Table 1, it can be stated that the fraction board has an average of 88.33% and is therefore in the valid category. Therefore, the fractional board can be continued at the trial stage.

Table 1. expert validation results regarding fractional boards

Criteria	Percentage %	Validity
The props are in accordance with the concept of fractions being taught.	75	Valid
The parts represented by the props are appropriately scaled and consistent.	100	Very valid
The materials used to make props are durable and not easily damaged,	75	Valid
Props are safe for use by elementary school students.	90	Very valid
Numbers, signs, and other parts of the teaching aids should be easy for students to read and understand. Colors and fonts should be clear and not confusing.	100	Very valid
Props provide opportunities for students to interact	90	Very valid
Props must be flexible in their use	75	Valid
The design and appearance of the props are attractive	90	Very valid
Instructions for Use: The props come with clear instructions for use	100	Very valid
Average	88.33	Very valid

The trial was carried out in class IV of SD N 31 Jati Tanah Tinggi, Padang City. Students are given mathematics learning material on adding fractions using fraction board media. The results obtained show that students show high interest in the fraction board and the size of the fraction board is also very appropriate. Next, an effectiveness test was carried out on the teaching aids and the results were shown as follows.

Table 2. Frequency distribution results of students' critical thinking abilities

Score range	Frequency	Criteria	Percentage %
90-100	2	Very critical	7
80-89	8	Critical	27
65-79	17	Quite critical	59
55-59	4	Not critical	7
<55	-	Very uncritical	0
Amount	29		100
Average	76.63		

Based on the Table 2, it shows that 93% of students have critical thinking skills. 2 students are in very critical criteria. Thus, fraction board media has a good impact on elementary school students' critical thinking skills.

This research aims to produce fraction board media that can train elementary school students' critical thinking skills. Quality products have valid, practical and effective criteria. Based on expert assessment tests regarding validity, it shows very practical results (Rahayuningsih & Setiawan, 2023). After meeting the validity aspect, the fraction board media can be continued at the trial stage. The trial phase showed high student interest and interest in fraction board media. Next, an effectiveness test was carried out in this case regarding the critical thinking skills of elementary school students. The results of the effectiveness test show that 93% of students have good critical thinking skills, thus it can be stated that fraction board media is suitable for use in real classes.

The results of expert validation stating that a learning media is valid is a very important first step in measuring the quality of the media. Media validity refers to the extent to which the media can be relied upon in measuring what it is intended to measure. In the context of training critical thinking skills in elementary schools, the validity of the media indicates that the tool really develops critical thinking skills as expected.

Furthermore, practicality results that show that the media is practical to use are an important factor in the successful use of learning media. Practical media can be easily implemented in the learning context in elementary schools without facing significant obstacles. The practicality of this media will make it easier for teachers to integrate it into daily learning.

Finally, the results of the media effectiveness test which state that the media is effective in training critical thinking skills is another important point. Media effectiveness refers to the ability of the media to achieve the learning objectives that have been set. In this context, effective media can improve students' critical thinking skills significantly. Theories about learning effectiveness, such as cognitive theory and constructivism, support the importance of using effective learning media to achieve optimal learning outcomes. Thus, the results of the media effectiveness test become an indicator of the success and relevance of the media in the context of developing critical thinking skills in elementary schools.

Conclusion

From the results of the research conducted, it can be concluded that the development of fraction board media has proven to be effective and relevant to the curriculum, supporting the learning outcomes of elementary school students, especially in addition of fractions material. The prototype design is made of wood, has parts that can be separated and reassembled, is equipped with clear labels and instructions for use, so that it can support teachers and students in using this media effectively. Validation by experts shows that this media is very valid with an average percentage of 88.33%, and can be safely and interestingly used by elementary school students, and provides opportunities for students to interact and work together in groups. The trials carried out also showed high interest from students and the suitability of the fraction board size, as well as showing a positive impact on improving students' critical thinking skills, where 93% of students had good critical thinking skills. Therefore, this fraction board is suitable for use as a learning medium to train elementary school students' critical thinking skills.

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Author Contributions

Vivi Puspita is the main researcher and author of this article. Wulandari Juli Zuwendri was in charge of collecting data and carrying out initial analysis and practicality and effectiveness trials, Alfiyandri who had designed the fraction board media and processed the validation data. Apart from that, Ika Parma Dewi also develops and tests research products.

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Conflicts of Interest

The authors declare no conflict of interest.

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