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Research Article

DEVELOPMENT OF ADDITION AND SUBTRACTION BOARD MEDIA (PAPEPENG) FOR 1ST GRADE ELEMENTARY SCHOOL STUDENTS

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Abstract
This study aims to develop and determine the quality of concrete media in mathematics learning, especially in addition and subtraction material in grade I Elementary School This research is a Research and Development study, using the Borg and Gall model Data collection techniques using interviews and questionnaires. Data analysis used qualitative and quantitative analysis. The numeracy ability of first grade students at SD Muhammadiyah Sunten, Sendangrejo, Minggir is not maximized, this is evidenced through interviews with class teacher as the homeroom teacher for grade I SD Muhammadiyah Sunten. There are still difficulties in counting, where the addition and subtraction material is a basic material that must be mastered, there is no concrete learning media in the school. The results of the assessment From the experts showed that the Addition and Subtraction Board (PAPEPENG) media was feasible to be used for field trials

Keywords: *PAPEPENG, Mathematics Learning, First Grader*

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INTRODUCTION

Mathematics is one of the most beneficial fields of knowledge for life, both in terms of its material and its usefulness. Mathematics is a field of knowledge that plays an important role in human life, as every life activity is inseparable from mathematical concepts. One of the aspects that needs to be developed in early childhood is mathematical ability. By understanding mathematical concepts, it is expected that children can improve their logical thinking skills. In

life, we are always faced with many calculations, arithmetic, and logic, which are very necessary for us to think correctly, because logic is an important part of mathematics (Sumarni, 2017:62). Furthermore states that in the 21st century, mathematics has become a tool for discovering new scientific principles, the use of atomic energy, the creation of computers, traffic control and communication, the creation of new vaccines and drugs, space navigation, the discovery of new mineral deposits, the prediction of population growth, and weather forecasting (Fadillah, 2024). This proves that mathematics is a compulsory subject that must be mastered, as it will be beneficial for human survival itself.

This research attempts to use learning media aids in Mathematics subjects, specifically on addition and subtraction material. The use of this learning media is expected to develop students' understanding in a more concrete and meaningful way. According to Sanaky (2011: 50), concrete media are real objects that can be presented in a room for the purpose of the learning process. This aligns with Ayhar (Diky et al.: 2019), who states that real objects or tangible items are things that students can see, hear, or experience, thus providing them with direct experience.

Learning media plays one of the most important roles in assisting teachers to support an effective teaching and learning process. The use of learning methods or media itself can make the learning atmosphere in the classroom more lively and make it easier for teachers to convey the material being taught. Basically, teachers must have guidelines or references before providing material to students. Before teaching a subject, teachers must prepare a Lesson Plan (RPP) which serves as a reference for providing sequential learning so that students can more easily grasp the content of the material taught and achieve learning objectives.

Learning media are tools used as intermediaries in the learning process. Effective learning media do not depend on whether they are expensive or cheap, but rather the frequency of their use depends on the suitability of the media's characteristics and the material being taught according to its developmental stage. Hengkang Bara Saputro (2015:64).

Sujiono, in Dadan Suryana (2016:110), stated that the goal of arithmetic is not to make children able to count up to a hundred or a thousand, but rather to understand mathematical language and its use for thinking. The purpose of arithmetic is for children to have logical and systematic thinking skills from an early age through observation of concrete objects.

The learning media (PAPEPENG) are expected to improve the arithmetic skills of first-grade elementary school students, especially in the basic concepts of addition and subtraction. The selection of this media is very important for the students' needs; this media is very beneficial for students because it can make learning more interesting and easier to understand. This media is not a completely new media that has never existed before, but rather this addition and subtraction board media (PAPEPENG) is a modified and updated version.

The objectives of this research are to describe the development procedure of the addition and subtraction board media (PAPEPENG) for first-grade elementary school students and to determine the quality of the addition and subtraction board media (PAPEPENG) based on the responses of media experts, material experts, and learning experts for first-grade elementary school students.

RESEARCH METHOD

Research Design

This study employs a Research and Development (R&D) design using the Borg and Gall development model. The research focuses on developing and validating learning media through several stages involving expert evaluation. The approach integrates both qualitative and quantitative components, particularly in data collection and analysis. The research was conducted at SD Muhammadiyah Sunten. The stages of data collection—interviews and expert

validations—were carried out during the period affected by the COVID-19 pandemic, which consequently limited the implementation of field trials with students.

Research Target/Subject

The research subjects consisted of media experts, material experts, and learning experts who were involved in validating the developed product. The target users of the product were first-grade students of SD Muhammadiyah Sunten. However, due to restrictions during the COVID-19 pandemic, the study did not reach the trial stage with the student participants.

Research Procedure

The research procedure followed the steps of the Borg and Gall R&D model. The process included:

1. Identifying the need for development
2. Designing and developing the learning media product.
3. Conducting expert validations involving media, material, and learning experts.
4. Revising the product based on expert feedback.

The procedure did not extend to the field testing phase with first-grade students due to pandemic-related constraints.

Instruments, and Data Collection Techniques

Data were collected using two main techniques:

- Interviews, conducted to obtain qualitative insights during the development process.
- Questionnaires, provided to media experts, material experts, and learning experts to gather quantitative and qualitative assessments.

These instruments were designed to measure the feasibility and quality of the developed learning media.

Data Analysis Technique

The study employed qualitative and quantitative data analysis techniques. Qualitative data from interviews and open-ended questionnaire responses were analyzed through thematic analysis, while quantitative data obtained from expert validation sheets were analyzed descriptively to determine levels of feasibility in relation to the research objectives

RESULTS AND DISCUSSION

The results of the research and discussion on the development of the Addition and Subtraction Board (PAPEPENG) learning media for first-grade elementary school students are as follows.

A. **Trial Data**

This research developed learning media in the form of an addition and subtraction board (PAPEPENG) which will be tested by Media Experts, Material Experts, and Learning Experts. This learning media can be used for the material of addition and subtraction of whole numbers up to 99 for first-grade elementary school students.

The development procedure in this research used the research procedure from Borg and Gall, developed by Sugiyono, consisting of ten steps, such as: potential and problems,

literature study and information gathering, product design, design validation, design revision, product trial, product revision, usage trial or extensive trial, product revision, and mass production. However, in the current situation or during the pandemic, the researcher only reached step five, which is design revision. The following is an explanation of the five initial development steps carried out by the researcher:

1. Potential and Problems

   In this stage, the researcher identified potential and problems occurring among first-grade students at SD Muhammadiyah Sunten by conducting interviews with the class teacher regarding the problems or obstacles students encountered during mathematics learning, especially in addition and subtraction. The interview was conducted on October 18, 2020, via WhatsApp with the resource person, Mrs. Muthmainah, S.Pd, the first-grade teacher. The interview questions focused on the difficulties or obstacles students faced in mathematics learning and the need for learning media in the learning process.

   Based on the interview results, the problem or obstacle identified was that students still experienced difficulties in mathematics, specifically with addition and subtraction material. These difficulties arose due to several factors, such as: not yet fluent in basic addition and subtraction calculations, with some students being quick and others still slow, and a lack of concrete learning media used during the learning process. Mrs. Muthmainah, S.Pd, stated that the use of learning media in the learning process, especially in mathematics, is indeed very necessary to assist in conveying material and can also be used to foster interest and enthusiasm for learning during the mathematics learning process. Based on the initial interviews and information gathering conducted by the researcher with Mrs. Muthmainah, it can be concluded that first-grade students at SD Muhammadiyah Sunten need the development of learning media. Media development is also needed to make it easier for students to understand addition and subtraction material and to improve students' calculation abilities.

2. Product Design

   In this stage, the researcher designed the initial product of the media to be created, which is a concrete learning medium named PAPEPENG (addition and subtraction board). The design of this media is based on the basic concepts of addition and subtraction commonly used by teachers to simplify the explanation of addition and subtraction material to students. The PAPEPENG media is designed according to the characteristics of elementary school students. The researcher also prepared supporting components in the form of learning devices such as lesson plans (RPP), teaching materials, and evaluations.

B. **Data Analysis**

After creating the design of the product to be developed, the researcher proceeded to the validators for the validation of the research instrument. The instrument was then taken to media experts, learning experts, and material experts to obtain evaluations from each expert according to the product that had been created. Subsequently, the evaluation results from the experts will be used as a basis for improving the media before it is trial-tested.

C. **Product Revision**

In this stage, the researcher carried out revisions or improvements to the initial product that had been designed and created. Suggestions, input, or evaluations from media experts, learning experts, and material experts were used as references to revise or improve the product, then consulted again until the media experts, learning experts, and material experts declared that the product was feasible and ready for field testing. According to the media experts, some parts needed to be improved. The media revisions carried out are as follows:

1. Adding explanations in the user manual

The initial display in the user manual did not mention what components were included in the PAPEPENG learning media and the functions of each component within the media. After revision by the media experts, it was recommended to add explanations for each component within the PAPEPENG learning media.

2. Adding identity in the material and usage
   The initial display in the user manual did not mention the identity of the material and its usage, such as for which grade this media is used, what competencies are achieved, the objectives, and other related information. After revision by the media experts, it was recommended to add the identity in the material and its usage.

D. **Final Product Review**

The development of the addition and subtraction media (PAPEPENG) has been completed. The development of the addition and subtraction board media (PAPEPENG) was carried out step-by-step, following the development procedures, resulting in media that is feasible for use. The creation of the addition and subtraction board media (PAPEPENG) has undergone a series of evaluations from the validation of media experts, material experts, and learning experts. This was done to obtain data used for revising the media. The final product of the addition and subtraction board learning media (PAPEPENG) consists of several parts.

CONCLUSION

The learning media *Addition and Subtraction Board (PAPEPENG)* was developed using the Borg and Gall research and development model, which consists of ten stages. However, due to limitations caused by the COVID-19 pandemic, this study was conducted only up to the fifth stage. Despite this limitation, the development process was carried out systematically and yielded meaningful results. The first stage, potential and problems, was conducted through preliminary observations and interviews with the Grade I teacher at SD Muhammadiyah Sunten. The findings revealed that students experienced difficulties in understanding addition and subtraction concepts, and teachers faced challenges in delivering mathematics material effectively due to the lack of concrete and engaging learning media.

The second stage, data collection, involved a literature review and information gathering related to mathematics learning for lower-grade students, learning media development, and concrete learning aids. The results of this stage provided a theoretical foundation for designing learning media that aligns with students' cognitive development and learning needs. In the product design stage, the researcher developed a concrete learning medium called PAPEPENG (Addition and Subtraction Board). The media was designed using materials such as wood, a sliding board, a whiteboard, marbles, and paint. The design emphasized simplicity, durability, and visual attractiveness, while also aligning with the basic competencies of addition and subtraction for Grade I students and considering their developmental characteristics.

The fourth stage, design validation, aimed to assess the feasibility and quality of the developed learning media. Validation was carried out by media experts, material experts, and learning experts. Media experts evaluated aspects related to design, appearance, and usability; material experts focused on the accuracy and suitability of the mathematical content; and learning experts assessed instructional aspects and alignment with learning objectives. Based on expert evaluations, PAPEPENG obtained a score of 74 from media experts, 72 from material experts, and 78 from learning experts. All scores fell within the *good* category. These results indicate that the learning media meets the required standards in terms of design, content, and instructional quality. The fifth stage, design revision, was conducted based on feedback and suggestions provided by the experts. Revisions were made to improve clarity, functionality, and instructional effectiveness of the media. Overall, the results show that the Addition and Subtraction Board (PAPEPENG) is a feasible and good-quality learning medium for use in

mathematics instruction. The media can assist teachers in simplifying the delivery of addition and subtraction material and supports students' understanding through concrete and interactive learning experiences

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation; Validation

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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