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DEVELOPMENT OF POP-UP BOOK MEDIA BASED ON PROBLEM-SOLVING ON FRACTION MATERIAL

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Abstract

This study aims to produce pop-up book media based on problem-solving in fractions in 4th grade of Elementary School that meet valid criteria and deserve to be developed. This research uses a development method that makes certain products and tests the effectiveness of these products. The development model used is the ADDIE model. Sampling used a random sampling technique with instruments in the form of media feasibility validation questionnaires given to 5 validators consisting of 3 expert validators and 2 Mathematics teachers. Based on the research and development results, problem-solving-based pop-up book learning media on fractional material developed through the ADDIE development model obtained an average feasibility percentage of 93.90%. At the same time, problem-solving-based pop-up book media that has been applied to students shows that 88.72% of students are happy with the learning.

Keywords: ADDIE model; fraction; pop-up book.

Abstrak

Tujuan dari penelitian ini yaitu menghasilkan media buku pop-up berbasis pemecahan masalah pada pecahan di kelas IV Sekolah Dasar yang memenuhi kriteria valid serta layak untuk dikembangkan. Penelitian ini menggunakan metode pengembangan yang menghasilkan produk tertentu dan menguji keefektifan produk tersebut. Model pengembangan yang digunakan adalah model ADDIE. Pengambilan sampel menggunakan teknik random sampling dengan instrumennya berupa lembar angket validasi kelayakan media yang diberikan kepada 5 validator yang terdiri dari 3 validator ahli, dan 2 guru Matematika. Berdasarkan hasil penelitian dan pengembangan maka dapat dinyatakan bahwa media pembelajaran pop-up book berbasis problem solving pada materi pecahan yang telah dikembangkan melalui model pengembangan ADDIE diperoleh persentase kelayakan rata-rata sebesar 93,90%. Sedangkan untuk media pop-up book berbasis problem solving yang telah diterapkan pada siswa menunjukkan bahwa 88,72% siswa senang dengan pembelajaran tersebut.

***Kata kunci**: buku pop-up; model ADDIE; pecahan.*

INTRODUCTION

Mathematics is an exact science in learning that students must master. This is because mathematics has an important function in the thinking process of solving a problem systematically and logically (Riski, 2021). In addition, mathematics is considered important because it can give students the ability to think logically, creatively, critically, systematically, analytically, and work together. (Resmaniti & Karlimah, 2019). Although mathematics has an important role, but it is a subject displeased by students. One of the

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factors is that students make mathematics a complex subject. Pamuji et al. (2014) says that students' interest in learning mathematics is still lacking, this is because the lesson hours seem long, there are many formulas that are difficult to understand. Teachers must be able to provide a change in presenting subject matter, so that the learning process becomes more qualified and students can learn quickly and pleasantly (Nurhayati, 2019, Nurhayati, 2020; Zuhra et al., 2021).

One way that teachers can take is to use learning media. Media is one part of the learning component is needed to increase the effectiveness in achieving learning objectives (Dewanti et al., 2018; S. Widodo & Wahyudin, 2018; Safri et al., 2017; Setiyanigrum, 2020). In addition, learning media can also create innovations and generate enthusiasm for learning. This is because the key to learning success is attracting students' interest by displaying learning media (Qondias et al., 2016; Hartanti et al., 2020). The function of using instructional media is to attract students' attention, deliver learning materials, and assist students in understanding the material being studied (Dewanti et al., 2018; Bulut et al., 2015; Wibowo, 2013; Yuniati et al., 2011). Pop-up book media is one of the learning media that can make students learn while playing and can make students interested and not bored during the teaching and learning process.

The pop-up book is a unique and exciting learning media to help students understand the material taught (Ahmadi et al., 2017; Hanifah, 2014; Iizuka et al., 2011; Mahadzir & PHUNG, 2013). Pop-up books have their charm for students. Pop-up book media is advantageous in providing opportunities and learning experiences because students are directly involved in using pop-up book media, such as sliding, opening, and folding. Students understand the material well, and it will be stored in their memory for a long time. (Safri et al., 2017; Hardjo et al., 2017; Kusno & Kusuma, 2018). Many pop-up book learning media have been developed. Qondias et al. (2016) developed thematic learning media based on mind mapping at elementary school. Furthermore, the development of pop-up book media in the learning process in elementary schools (Nur et al., 2017; Safri et al., 2017; Hartati, 2018; Masturah et al., 2018; Fitri & Karlimah, 2018; Dewanti et al., 2018; Sinta & Syofyan, 2020). Developing audio-based pop-up book learning media on quadrilateral material in junior high school (Baiduri et al., 2019). Development of pop-up book media in science lessons in elementary school (Sinta & Syofyan, 2020). Develop pop-up media based on CTL in achieving problem-solving skills (Oktaviana et al., 2020).

Of the many developments in pop-up media, research has yet to develop problem-solving-based pop-up media. Problem-solving is a high-level ability for students to learn mathematics (Andriani, 2017). Problem-solving aims to see students' understanding of the material (Purwaningsih & Ardani, 2020). Problem-solving is a student's ability to solve a problem using the appropriate stages (Purwaningsih & Ardani, 2020; Widodo & Amalia, 2020). Problem-solving is necessary to determine the level of student mastery of a material and train students to apply their knowledge to various problems (Wahyu Indriyani & Masriyah, 2016; Tomo et al., 2016). Therefore, with the development of problem-solving-based pop-up book media, students can

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discover mathematical concepts, especially fractions.

Fractions are one of the elementary school materials closely related to everyday life, so students' ability to solve problems is needed. Fractions are essential material that students must master because fractional material is related to decimals, comparisons and scales, and measurements (Irfan et al., 2018). Therefore, problem-solving-based pop-up book media can help students provide solutions related to fractions. Based on this statement, this research aims to produce a pop-up book based on problem-solving on fractions in grade IV Elementary School.

METHOD

This development research was conducted to produce a pop-up book product based on problem-solving and to test its effectiveness. The ADDIE model consists of the stages of analysis, development, implementation, and evaluation in this study (Pribadi., 2010). The product developed was a pop-up book media based on problem-solving conducted at SD Negeri 2 Bireuen. The selection of the research location was based on observations and interviews, which concluded that the elementary school experienced problems in learning mathematics on fractional material, so researchers want to find a solution to the problem. The product trial process will be held on February 8-9, 2021.

The population in this research was all 4th-grade students, totaling two classes, and all teachers teaching mathematics at SD Negeri 2 Bireuen, counting 11 people. The test subjects were 19th graders of class IV/B and two teachers who taught mathematics in class IV of SD Negeri 2 Bireuen. Sampling was done by using a random sampling technique. The instrument used was a media feasibility validation questionnaire sheet given to 3 expert validators and 2 Mathematics teachers from several schools in Bireuen. The validation results from several validators were then averaged and analyzed using percentage techniques.

RESULTS AND DISCUSSION

This research aimed to develop pop-up book learning media based on problem solving with the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. The ADDIE model has clear steps and flexible guidelines that can assist researchers in developing effective media. (Safri et al., 2017b).

1. Analysis

The analysis stage was done in December 2020 when researchers conducted observations and interviews at SD Negeri 2 Bireuen. At this stage, researchers analyzed several aspects: materials and learning processes, facilities, and learning media that are often used. The observations on parts of the learning process revealed that the learning process still used the lecture method, students were not actively involved in learning, and the learning process was still teacher center. The results of the researcher's interview with one of the mathematics teachers and several students in 4th grade of SD Negeri 2 Bireuen stated that the fraction material was usually taught by the lecture method with whiteboards and textbooks. No computer laboratory is available, causing multimedia media never to be used. Problem-solving-based pop-up book media has never been used in this school. Based on the needs analysis in terms of these three aspects, it becomes a problem for students. At this stage, researchers

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analyzed several elements: materials and learning processes, facilities, and learning media that are often used. Supposedly, several other alternative media are used in learning mathematics, so it was decided to develop the pop-up book media based on problem-solving on fractional material. One of the reasons for developing problem-solving-based pop-up book media is that this media has never been applied in SD Negeri 2 Bireuen. It is hoped that this media can become one of the new variations in learning mathematics.

2. Design

In the design stage, the problem-solving-based pop-up book learning media is designed to be as attractive as possible so that the resulting media can motivate students to study mathematical material, especially fractional material, so the learning process will be more enjoyable later. Some of the components needed at this design stage are the tools and materials required in designing pop-up book learning media, namely laptops/computers, fraction material books, syllabus, pictures related to fractions, scissors, HVS paper, pencils, ruler, cutter, and glue. The problem-solving-based pop-up book was created with multiple pages. The contents of each pop-up page that will be made can be seen in Table 1.

Table 1. Contents on Each Pop Up Book Page

No	Page	Content
1.	1 - 2	Opening Page - List of Content - Learning Objectives - Instruction for using media
2.	5 - 6	Definition of Fraction - Fraction Illustration - Examples of Fraction - Fractional reading materials
3.	7	Sorting fractions - Illustration - Explanation
4.	8	Comparing fraction - Illustration - Explanation - Exercises
5.	9 - 10	Fractional Types - Common fraction - Mixed fraction - Fractional percent - Decimal fraction
6.	11-12	Operations for addition and subtraction of fractions - Add and subtract fractions with the same denominator - Add and subtract fractions with different denominators
7.	13	Ability test
8.	14	Bibliography

3. Development

The media was made at the development stage using prepared components, tools, and materials. The locations of developing pop-up book learning media based on problem-solving were: (1) searching and collecting tools and materials that would be used for pop-up book learning media based on problem-solving, (2) preparing materials to be developed in learning media, (3) printing of pages, (4) making covers using cardboard as the lining material, and (5) assembling the parts of the pages that have been systematically arranged and installing the Pop-Up parts in the pages of the pop-up book learning media based on problem-solving.

All materials or components from the analysis and design stages would be gathered into one and converted into a ready-to-use media form. The printed product was then validated by a validator consisting of 3 expert lecturers (media, language, and material experts) and a mathematics teacher. The

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assessment process was carried out by providing pop-up book learning media based on problem-solving ready to be reviewed. Validation questionnaires were accompanied by suggestions for improving problem-solving-based pop-up book learning media. Table 2 shows some inputs from the validator on the problem-solving-based pop-up book learning media.

Table 2. Validator's feedback on pop-up book media based on problem solving

No	Validator	Feedback
1.	Media Expert	- The media color is varied to make it more attractive, it is better to use bright colors because it uses a black background - For the background should be the same for each page - Use better adhesive to prevent pop-ups from coming off easily. - Create instructions for use so that students can use it more easily
2.	Linguist	- Use standard words according to the Indonesian Spelling System - If there is a language that students rarely hear, it is better to make a glossary - Fix typing errors
3.	Material Expert	- It is recommended to use predominantly problem-solving-based questions - Create special materials about fractions for fourth-grade elementary school - Each question should have a solution method (answer key)
4.	Mathematics Teacher	- Each material should be made with examples of questions and how to solve them - The answer key should be given so that students can know the right and wrong answers to the questions

Based on input from the three validators, the pop-up book media based on problem-solving was revised again. Improvements to the pop-up book media based on problem-solving were carried out thoroughly regarding background color and color on each page. Revisions were carried out referring to the suggestions the validator gave until the media was suitable for use without modification. The results of revising the pop-up book media based on problem-solving have been feasible to use without correction, as seen in Figure 1.

Figure 1. Pop-Up book media approved by validator

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In addition to providing suggestions/input on the pop-up book media based on problem-solving, the validator also provides an assessment (validation) of the media. The percentage of validation results for each validator can be seen in Figure 2.

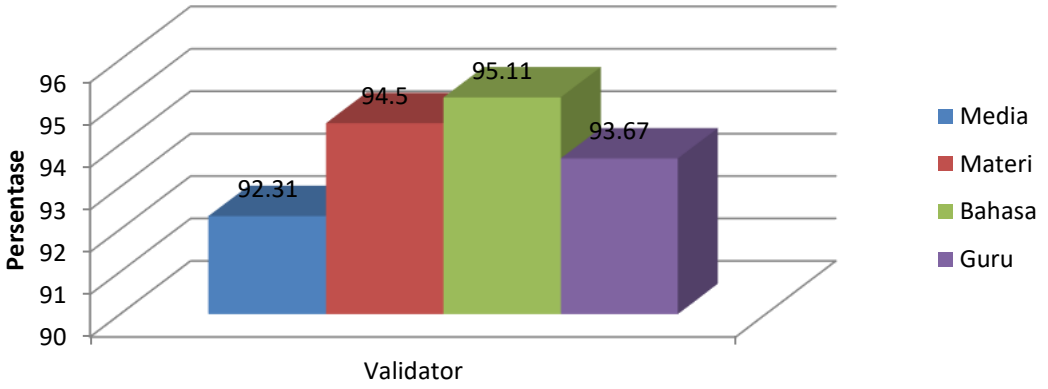

Figure 2. Results based on problem solving pop-up book validation

The average validation results of 5 validators on the pop-up book media based on problem-solving with the ADDIE development model were 93.90% with very feasible qualifications. This is in line with (Safri et al. 2017), who developed a pop-up book media with five validators who got an average percentage of 92.67%.

The produced media has bright and clear colors with a black background. The colors used in the media have a good psychological effect on the reader (Sentarik & Kusmariyatni, 2020). Each color used in the pop-up book media can evoke spontaneous feelings and has unwittingly influenced the reader's emotions (Luzar, 2011). Then, (Zuhra et al. 2017) stated the same thing: books that use few colors and pictures have a less attractive appearance, which can cause students' low interest in reading.

The colors used in the pop-up book media that have been developed have a psychological effect on the reader (Zuhra et al. 2017) as follows: Blue has extraordinary characteristics and symbolizes calm, so students will feel comfortable when using this media. Yellow can encourage students' self-expression, inspire them, make it easier to think logically and stimulate the intellectual abilities that exist in students. Purple can attract attention and increase the power of intuition, fantasy, imagination, and creative students. White symbolizes students' purity and innocence, giving the impression of protection and facilitating reflection. Black has a strong and confident color. With these colors, students who use pop-up book media can get psychological influence without realizing it.

4. Implementation

Implementation is a concrete step to apply the learning media that have been made. At this stage, everything that has been developed is arranged so it can be implemented to the target. The test on the teacher was carried out on February 8, 2021. The test on the teacher was carried out by showing the pop-up book learning media that had

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been developed and explaining how to apply it to the lesson plan that the researcher had made. The purpose of the trial on teachers was to find out the teacher's response to the pop-up book learning media that has been developed. The test on students was carried out in class IV/B SD Negeri 2 Bireuen on February 9, 2021, totaling 19 students. The trial was carried out per the lesson plan the researcher had made. Students were divided into several groups and given a pop-up book learning media for fractions to discuss. After learning was completed, students were given a questionnaire to determine their response to learning fractions using pop-up book media based on problem-solving. The result of this research was 88.72% of students were happy with learning by using pop-up book media based on problem-solving.

5. Evaluation

Evaluation is the last stage of the ADDIE development stages. After the implementation, the response of teachers and students to the learning media pop-up book fraction material that has been developed will be found. Then it would be evaluated if there are deficiencies in actual conditions. The results of the implementation of teachers and students obtained pop-up book learning media were in a perfect category, so no evaluation or improvement is needed, according to Safri et al. (2017). However, the thing required in the evaluation stage was to improve the product based on the results of implementing the developed media.

The problem-solving-based pop-up book learning media can be applied to fractional material in grade IV SD. The problem-solving-based pop-up book developed is designed in such a way that it gets good validation results from the validator. This research results align with Ningtiyas et al. (2019) and Masturah et al. (2018), which developed a pop-up book for science subjects. This development product is said to be valid with the acquisition of a validity level above 90%. Dewanti et al. (2018) developed a pop-up book for learning about the environment where I live. Overall validation results with Very Valid criteria, and this media is very suitable for use in Thematic learning on the sub-theme of My Living Environment. Then, Fadillah dan Ninawati (2020) developed a contextual-based pop-up book on animal development material; the results of this research stated that the pop-up book learning media on animal breeding material was very suitable to be used as a science learning medium.

CONCLUSION

Based on the results of research and development that has been carried out, it can be concluded that the pop-up book learning media based on problem-solving on fractional material has been developed through the ADDIE development model consisting of the stages of analysis, design, development, implementation, and evaluation with an average feasibility percentage of 93.90%. This shows that the pop-up book learning media based on problem-solving on fractional material can be used as a learning media.

The pop-up book media based on problem-solving has been implemented for the fourth-grade students of SD Negeri 2 Bireuen. The result is that 88.72% of students are happy learning using pop-up book media based on problem-solving. Hopefully, the pop-up media that has been developed can be implemented in this type of experimental research.

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As for the suggestions from this study, it is hoped that problem-solving-based pop-up book learning media can be implemented in fractional material to improve student learning outcomes. Furthermore, for further research can develop pop-up books based on solving other mathematical problems.

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