

Movable Page-Based Interactive Books on Numbers in Elementary Schools

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Abstract

The development of a Movable Page-Based Interactive Book on Numbers in Elementary Schools aims to determine the feasibility and effectiveness of the product being developed. The use of teaching materials has an important role including the role for students, teachers in classical learning, groups and individuals. An interactive book based on Movable Pages is a teaching material that is systematically arranged to help students understand the concept of numbers in elementary schools. This study uses a development research approach by applying the ADDIE Model (Analyze, Design, Development, Implementation, Evaluation). Research that has been carried out up to the Development stage. Based on the results of the research that the development of movable page-based interactive books on number material of n elementary schools was developed declared and valid by 4 (four) validators, with a percentage of 90.4% in the very valid category. In the implementation stage, namely the product trial stage, namely one-to-one and small group trials which were carried out in class V students at SD Negeri 11 Sungai Pinang as many as 21 students, the results of the student questionnaire recapitulation were 89.7% with the very good category. Thus, from the several stages that have been passed in this study, it was found that the Movable Page-Based Interactive Book on Numbers Material in Elementary Schools is valid and practical. This interactive book can help elementary school teachers so that students can easily understand number material in learning mathematics and further researchers can continue this research to determine the effectiveness of interactive book products and can develop interactive books for other materials in learning mathematics in elementary schools.

Keywords: ADDIE model, interactive books, learning mathematics, movable pages

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1. Introduction

According to James and James (Suganda, 2022) Mathematics is the science of logic, regarding shape, arrangement, quantity, and concepts related to one another. Mathematics is divided into three major sections, namely algebra, analysis and geometry. But there are opinions that say that mathematics is divided into four parts, namely arithmetic,

algebra, geometry and analysis with arithmetic including number theory and statistics. Rahma (2018) mathematics is a science that studies logic, shape, structure and concepts related to one another. Learning mathematics is close to life because every life is related to the name of the count.

Students' conception of integers can be formed because they are used in everyday

student life (Maizora & Rosjanuardi, 2020; Putri et al, 2022). In learning mathematics in elementary schools, there are learning competency standards. Mathematics learning in elementary schools is adjusted to graduate competency standards, namely the domain of attitudes, skills and knowledge. Then it consists of class core competencies and mapping of basic competencies 1 and 2 as well as 3 and 4 (Mirdanda, 2019).

Students who have an understanding of a mathematical concept are students who can develop their knowledge, can interpret, exemplify, classify, summarize, conclude, compare, explain an object or event in their own language (Febriyanto, et al., 2018). In line with the opinion of Febriyanto (Romansyah, 2018) states that learning mathematics is a process of acquiring knowledge that is built by students themselves and must be done in such a way as to provide opportunities for students to rediscover mathematical concepts. From this opinion, students fulfilling the indicators of understanding concepts will not encounter significant difficulties in receiving new knowledge in learning mathematics.

However, in reality in the learning process there are students who do not meet the indicators of understanding mathematical concepts, so that students encounter difficulties both in learning and solving mathematical problems. The results of the study (Rahmadan, 2022) found that 16 out of 20 students in grade IV had difficulty changing the form of a mixed fraction to an ordinary fraction and 18 out of 20 students had difficulty equating the denominator in two fractions with different denominators. Research Rohani (2021) states that one of the difficulties experienced by grade II students is due to a lack of understanding of the concept of long-decker addition and subtraction.

The causes of students' understanding of

mathematical concepts as described, the teaching and learning process used by the teacher is to only discuss the material being studied without instilling mathematical concepts in students through in-depth understanding, besides that the teacher only gives routine questions whose results can be solved procedurally (Fatqurhohman, 2016). So indirectly students are only trained in arithmetic skills and the tendency to memorize existing formulas. The results of Febriyanto's research (2021) regarding how to overcome students' learning difficulties in mathematics, one of which is by involving students in learning.

The method used to diagnose students' difficulties in learning mathematics is effective, as evidenced by changes in student understanding and increased student learning outcomes. The previous research, namely research entitled increasing understanding of mathematical concepts through the use of pictorial media bags on multiplication numbers in grade II elementary school (Febriyanto, 2018). Then research (Shofiah, 2021) the ability to understand mathematical concepts of elementary school students through online learning with the WhatsApp application. Research on teaching materials for learning mathematics in the 2013 curriculum based on picture stories in elementary schools (Suganda, 2022).

This study focuses on number material in elementary school because number material is the initial material that is introduced to students in elementary school. This is a research consideration because the emphasis on understanding the concept of learning mathematics is highly prioritized to support understanding mathematical materials at a higher level. In this study the choice of involving students in learning as a solution to increase understanding of concepts in the process of learning mathematics by using

books is made more attractive to students and can make students actively involved in learning, both individually and in groups. In this study the book in question is the development of a book that has pages filled with images that can be moved/demonstrated by students in understanding the concept of learning mathematics. Researchers have also distributed questionnaires to elementary school teachers for needs analysis data, whereby distributing questionnaires using the Google form to elementary school teachers, namely as many as 41 teachers. The results of the questionnaire indicate that it is necessary to develop a Movable Page-Based Interactive Book on Number Material in Elementary Schools with a percentage of 100% stating that they strongly agree to develop a Movable Page-Based Interactive Book on Numbers Material in Elementary Schools, so as to assist teachers in delivering mathematics learning material in elementary schools by easy and students have good motivation to understand the material.

Learning is best delivered when students are actively engaged in the learning process (Baring & Barame, 2022). Interactive books are the right communication media to provide learning to children because they not only contain messages but also have an interactive side where children can learn to imagine and at the same time act as a medium for play. Children not only learn but also contain elements of fun in books as a medium for entertaining children (Hartono, 2017). Previous research (Idris, 2020) stated that there is an interactive participation book, namely by inviting readers to follow instructions to find out with mixed page flow (forward – backward).

From the explanation above, in this study the interactive book that will be developed is a type of interactive book that contains explanations or stories accompanied by

questions and answers and or instructions for doing something in order to test the explanations or stories in the book. The following is an example of an interactive participation book display.

In this study, researchers sourced from previous studies that discussed movable books and pop up books. From several sources, researchers are interested in modifying it to become a Movable Page. This is because the book developed by the researcher, there are pictures on some pages of the book that can be moved, whereas compared to a movable book, that is, all the pages of the book can be moved.

From previous research (Hasanudin, 2020) with the title collaborative application, pop-up, and movable book to create 3D learning media for teachers in Geger village, it was stated that the first movable book published in large quantities was produced by Dean & Son, a publishing company founded in London before 1800. The following is a picture of Hasanudin's research results.

Movable Pages are also inspired by pop up books, where from research (Siregar, 2016) pop up books provide more enjoyment for children to read because when reading pop up books the child can imagine and interact with what they read by touching the pictures. that appears in the book. In addition, parents and teachers will find it easier to teach children to read because the media that children will read attracts their hearts. Research (Magdalena, 2020) entitled the family pop-up book model to accelerate the reading ability of low-grade elementary school children, along with pictures of the research products. From other previous research (Syafutri, 2019) with the title movable book development to improve students' science process skills that movable book is one of the media that can help to deliver subject materials and science process skill contents.

Based on several sources, the researcher plans to develop a book on mathematics learning in elementary schools, which aims to help elementary school students understand mathematical concepts. The modification of this research from previous research is that this book has only a few pages where the pictures can be moved as a demonstration of number material which can be demonstrated individually or in groups and will be designed to have feedback for students to find out whether or not the demonstration is carried out by students. Therefore, the researchers named it the Movable Page-based Interactive Book.

This Movable Page-based interactive book as a teaching material is systematic, meaning that it is arranged sequentially to make it easier for students to learn. In addition, this teaching material is unique and specific. Unique means that teaching materials are only used for certain goals and in certain learning processes, and specific means that the contents of teaching materials are designed in such a way as to only achieve certain competencies from certain targets (Magdalena, 2020). The use of teaching materials has an important role according to Tian Belawati (Sungkono, 2009) includes roles for students, teachers in classical learning, groups and individuals.

So it can be concluded that Movable Page-based interactive books are teaching materials that are arranged systematically to help students understand the concept of numbers in elementary school. The use of Movable Page-based interactive books can be used individually, in groups and classically in learning.

In this research, the plan to develop an interactive book based on Movable Page is focused on number material for initial material such as the concept of arithmetic operations on whole numbers, the concept of frac-

tions and arithmetic operations on fractions. The following is an example of presenting a movable page.

Learning Mathematics in Elementary Schools requires demonstration assistance in presenting the material. This is so that mathematics becomes more meaningful, so that the material can be conveyed clearly to students. The demonstration designed in this study is that students can demonstrate the props that have been presented in the developed book by themselves, meaning that students can move, move the demonstrations themselves in accordance with the agreement. This research is in line with previous research that is about Mathematics, Touch-Times and the Primary School Teacher: Generating Opportunities for Transitions Across and Beyond oleh (Bakos, 2022), then The meaning of meaningful learning in mathematics in upper-primary education by (Polman et al., 2021).

2. Method

This design of research is the ADDIE research and development model. The R&D model determined by the ADDIE Model consists of five stages of Analysis, Design, Development, Implementation and Evaluation. The development procedure used in this study is based on the ADDIE development model (Suganda, 2022) using the formative evaluation method.

The development of Movable Page-Based Interactive Books on Number Material in Elementary Schools has been carried out through three stages, namely preliminary studies, product development and product trials. This Movable Page-Based Interactive Book on Numbers Material has gone through the expert review stage involving 4 (four) validators including material experts, media and language experts as well as 1 practition-

er, namely a class V teacher at SD Negeri 11 Sungai Pinang.

The analysis phase was carried out before developing an interactive book based on movable pages. The analysis carried out is a needs analysis of interactive books. Data was collected through the results of research on the analysis of students' difficulties with number material. At the design stage, the researcher prepares materials to design the product to be developed. The product design is made from the results of an analysis of the achievement of competence in the number material, as well as analyzing problems that can be presented in an interactive book based on movable pages. The researcher makes an initial design in the form of a table which will be displayed on prototype 1. In the development stage, the researcher makes a product by making the results of an analysis of the achievement of competence for each content of number material. Furthermore, the researcher decomposed the book material by formulating new learning objectives that were adjusted from the results of the analysis.

In the self-evaluation stage, the researcher self-evaluates the interactive books that have been developed, before entering the

stages of validation by experts and product trials. Here the researcher asks for suggestions from colleagues to improve product design. This evaluation is carried out when researchers design and develop prototypes. Expert review validation is carried out by material, media and language experts. Validation of material, media and by practitioners is carried out to assess the material and in terms of interactive book products.

One-to-one Evaluation, the product is tested on 3 until 6 elementary school students. At this stage, questionnaires were distributed to students to find out their responses to the prototypes that had been developed as well as to measure them. Student comments at the one-to-one evaluation stage were used to make revisions to produce prototype II. Small Group Evaluation Stage, prototype II was tested in small groups with the aim of seeing deficiencies which could then be corrected before entering the field trial stage. Prototype II was tried out, at this stage, a questionnaire was given to students to measure the practicality of the prototype. Student comments at the small group evaluation stage were used to make revisions to produce prototype III. The Figure 1 is the interactive book development procedure.

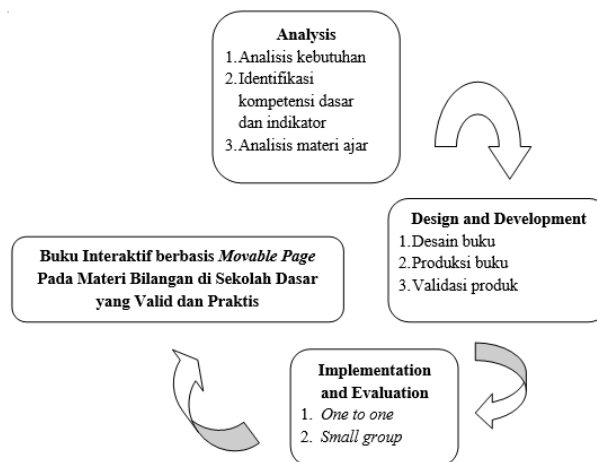


Figure 1. Interactive Book Development Procedure (Suganda Modification, 2022)

The product validity test was carried out by 4 validators consisting of material ex-

perts, media experts, language experts and 1 practitioner. The material expert validator

was Erika Kurniadi, S.Pd., M.Sc. in Mathematics, media expert by Mrs. Dr. Erna Retna Safitri, M.Pd., linguist by Rizki Turama, S.Pd., M.A. and practitioners by Sendy Putri Melati, S.Pd.

This research was carried out until it reached the small group trial stage, namely knowing the practicality of the book being developed and having been declared valid by experts. Data collection techniques in this study were using questionnaires. The questionnaire that will be used aims to determine the practicality of the book. This question-

naire will be used in the One-to-one Evaluation and Small group evaluation stages.

The data obtained were analyzed quantitatively and qualitatively and then interpreted. This study used data analysis techniques for development data which included validity and practicality tests. The validity test was carried out by expert validators including movable page-based interactive books. Determination of the conclusions that have been reached is based on the percentage assessment criteria as shown in the following table 1.

Table 1. Percentage data assessment criteria for product validation

No.	Score (%)	Conclusion and follow-up
1	80-100	Valid
2	65-80	Enough valid
3	≤65	Invalid

(M., Vina, et al., 2022)

The practicality analysis was obtained from the results of the questionnaire at the one to one and small group stages. The results of the questionnaire obtained were analyzed using a Likert scale, with four categories, namely: strongly agree (score 4), agree (score 3), disagree (score 2), strongly disagree (score 1). The data obtained from the questionnaire was then analyzed using the following percentage technique.

$$P = F/N \times 100\%$$

P = the percentage sought for each answer

F = Frequency of answers obtained

N = Frequency of all answers

100 = Fixed quantifier

The data from the percentage results are then converted using modified criteria from Sugiyono (Suganda, 2022) with the aim of knowing whether this book is practical to use. The categories are as follows.

Table 2. Criteria for assessing percentage data for practicality

Practicality	Category Average
81 – 100	Very Good
61 – 80	Good
41 – 60	Fairly Good
21 – 40	Less Good
≤ 20	Not Good

Based on table 2, the product is said to be practically average, in the good category. The range of values ≤ 20 to 60 products is said to be impractical and some parts of the

book's contents will be revised and will be tested again on students to obtain a range from 61 to 100, namely the practical category.

Through validity testing and practicality measurements, outputs or research products will be produced in the form of movable page-based interactive books that are valid and practical. So that these teaching materials can be used in order to help elementary students understand the concept of number material.

3. Result and Discussion

The ADDIE Model consists of five stages of Analysis, Design, Development, Implementation and Evaluation

a. Design


The Figure 2 is an interactive book cover display of the results of this study.



Figure 2. Cover

An example of the contents of the book. Here figure 3 is an interactive view of the contents of the book.

B. Penjumlahan Dua Bilangan Bulat
Ayo kita bermain dengan mengikuti persyaratan berikut.

 Mobil menghadap KANAN untuk operasi PENJUMLAHAN (+)

$a + b = \dots$

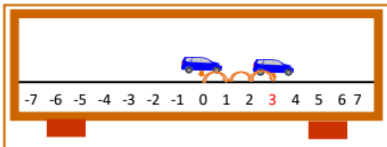
Jika a bilangan positif maka mobil bergerak MAJU.
Jika a bilangan negatif maka mobil bergerak MUNDUR

Jika a bilangan positif maka mobil bergerak MAJU.
Jika a bilangan negatif maka mobil bergerak MUNDUR

Gambar 4. Petunjuk peragaan operasi penjumlahan

Berikut contoh peragaanya:

1. $3 + 4 = \dots$



Langkah 1
Dari 0 maju 3 satuan

Figure 3. One of the Discussions in the Interactive Book Development

The research product is an interactive book based on Movable Pages on number material in elementary schools that has been designed and then developed to produce a product. The following is an interactive book product link that is still in the process of printing and ISBN registration <https://bit.ly/ProdukBukuInteraktif>. The development carried out is by conducting expert validation of the products that have been designed. The validation carried out

includes validation of material, media, language and by practitioners. Based on the final results of the validation carried out, it can be concluded that the research product that has been developed in the form of an interactive book based on Movable Pages on number material in elementary schools is declared valid and can be tested. A limited trial was conducted on fifth grade students at SD Negeri 11 Sungai Pinang.

For more details regarding the results of the validation test for the product in the validation carried out, it can be seen in the following table. the table of recapitulation of the results of the

Table 3. Movable Page Based Book Validation Recapitulation

Validator	Score (%)		Criteria	
	Validation 1 st	Validation 2 nd	Validation 1st	Validation 2nd
Material Expert	66,7	91,6	Invalid	Valid
Linguist	85	-	Valid	-
Media Expert	89,2	-	Valid	-
Practitioner	95,8	-	Valid	-
Average Category				90,4% Valid

Based on table 3, it can be seen that books based on Movable Pages are declared valid with an average percentage of 90.4%.

b. Implementation

Furthermore, the implementation of a limited trial of textbooks was carried out for students in semester 3 of the PGSD FKIP Unsri study program in the form of giving a questionnaire, with the aim of determining the practicality of the HOTS-based textbooks that had been designed. Practicality measurements from questionnaire sheets

filled in by 3 students (one to one stage) . Then from the results of the questionnaire a revision will be made if difficulties are found, then it is continued by giving a questionnaire to 10 (ten) students (small group stage) to re-measure the practicality of the textbooks that have been revised from the previous stage. The following table shows the results of the 3rd semester student questionnaire in the PGSD FKIP Unsri study program. The following is a recapitulation of the results of the trials that have been carried out in table 4 below.

Table 4. Recapitulation of Trial Stages

Trial	Total
<i>One to one</i>	101
<i>Small Group</i>	359
Total	460
Percentage	88,5
Practicality Category	Very Good

Based on table 4, it can be obtained that books based on Movable Pages are declared practical with a percentage of 88.5 in the very good category.

c. Evaluation

After being declared valid or feasible to be tested, it is carried out in 2 (two) stages, namely one to one, small group. The use of teaching materials has an important role according to Tian Belawati (Sungkono, 2009)

including the role for students, teachers in classical learning, groups and individuals. At the development stage, a prototype of an interactive book based on movable pages on number material has been compiled, so validation is then held by validators and practitioners. This is done to determine the level of validity of the interactive book. At this stage, the average validation result is obtained, namely with a total score of 101 out of a maximum total score of 120 or with a per-

centage of 84.2%, the category is very valid. In evaluating the validity, there are comments from experts, the comments given by the validators become a reference for researchers before testing this interactive book.

In the product trial stage, the stages that have been carried out are one to one and small group trials. At the one to one stage it is known that the use of teaching materials has an important role according to Tian Belawati (Sungkono, 2009) including the role for students, teachers in classical learning, groups and individuals have a very good level of practicality with a student questionnaire percentage of 84.2 %. After the one to one stage, the next stage was continued, namely the small group with the acquisition of a practicality level of 89.7% in the very good category. This Movable Page-based interactive book as a teaching material is systematic, meaning that it is arranged sequentially to make it easier for students to learn. In addition, this teaching material is unique and specific. Unique means that teaching materials are only used for certain goals and in certain learning processes, and specific means that the contents of teaching materials are designed in such a way as to only achieve certain competencies from certain targets (Magdalena, 2020).

The choice of number material as the material developed in this interactive book is because this material is the initial material for students getting to know mathematics. This is what makes researchers think that an interesting and innovative presentation is needed so that students can easily understand the number material. The scope of mathematics lessons includes several basic competencies that must be mastered by students, including: numbers, geometry, measurement and data processing (Risnayati, 2021).

This research is different from previous studies, namely the difference in the material

presented, the form of the image and appearance. As for previous research regarding (Siregar and Rahmah, 2016) the family pop-up book model to accelerate the reading ability of low-grade elementary school children. Syafitri (2019) with the title movable book development to improve students' science process skills that movable book is one of the media that can help to deliver subject materials and science process skill contents.

This movable page-based interactive book is in the form of a printed book whose pages can be moved or that means there is a demonstration that students can demonstrate directly. The researcher developed this book for the reason that elementary school students are still in the concrete operational stage, so there is a need for additional explanations in explaining the material to students, namely by demonstrating. This research is in line with previous research, namely Mathematics, Touch Times and the Primary School Teacher: Generating Opportunities for Transitions Across And Beyond (Bakos, 2022).

The difference with previous research lies in the use of technology, where the demonstration of material is directly on the touch screen, while my research was demonstrated in printed books or demonstrated manually. This is with the consideration that this interactive book can be disseminated in remote areas in Indonesia where there is still not much use of technology.

4. Conclusion

Based on the results of the research and discussion, it can be concluded that the Development of a Movable Page-Based Interactive Book on Number Material in Elementary Schools developed was declared valid by 4 (four) validators, with a percentage of 90.4% in the very valid category. In the product trial stage, namely one to one and small group trials, the results of the student

questionnaire recapitulation were 89.7% in the very good category. The score from One to one is 101 and the small group is 359, so the total is 460. Thus, from the several stages that have been passed in this study it was found that the Movable Page-Based Interactive Book on Numbers Material in Elementary Schools is valid and practical.

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