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BELITUNG: Mathematics Learning Media for Grade III Elementary School

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ABSTRAK

Konsep penjumlahan dan pengurangan bilangan bulat merupakan konsep yang mutlak harus dikuasai oleh setiap orang yang mempelajari matematika. Rendahnya pemahaman konsep matematika siswa disebabkan oleh peran guru dalam mengontrol proses pembelajaran. Oleh karena itu penelitian ini bertujuan untuk mengembangkan media Pembelajaran Berhitung Lintasan (BELITUNG) sebagai solusi dari permasalahan siswa dalam pembelajaran bilangan bulat untuk kelas III SD. Penelitian ini merupakan penelitian dan pengembangan (Research and Development) dengan model ADDIE. Data diperoleh dengan melakukan observasi, wawancara, dan kuesioner. Setelah dilakukan penelitian dan pengembangan pada media BELITUNG didapatkan skor ahli media 4,1 dengan persentase 82%, dan ahli materi 4,4 dengan persentase 88%. Keduanya menyatakan bahwa media ini sangat baik. Setelah diuji oleh ahli dan direvisi, selanjutnya dilakukan uji coba terbatas terhadap siswa yang didampingi oleh guru kelas sebagai praktisi ahli. Uji coba terbatas mendapatkan skor 4,7 persen 94% jika dikonversikan ke dalam kualitatif maka media dikatakan sangat baik. Berdasarkan penelitian dan pengembangan dapat disimpulkan bahwa pengembangan media BELITUNG untuk pembelajaran bilangan bulat kelas III SD menunjukkan media layak digunakan di kelas karena memenuhi kriteria sangat baik.

ABSTRACT

The concept of adding and subtracting integers is a concept that absolutely must be mastered by anyone who studies mathematics. Students still have low understanding of mathematical concepts is caused by the teacher's role in controlling the learning process. Therefore, this research aims to develop Counting Trajectory Learning media (BELITUNG) as a solution to students' problems in learning integers for grade III SD. This research is research and development (Research and Development) with the ADDIE model. Data was obtained by conducting observations, interviews, and questionnaires. After conducting research and development on BELITUNG media, it was found that the score of media experts was 4.1 with a percentage of 82%, and material experts 4.4 with a percentage of 88%. Both stated that this medium was very good. After being tested by experts and revised, then limited trials were carried out on students who were accompanied by the class teacher as expert practitioners. Limited trials get a score of 4.7 percentage 94% if it is converted into qualitative then the media is said to be very good. Based on research and development, it can be concluded that the development of BELITUNG media for learning integers for grade III SD shows that the media is suitable for use in class because it meets very good criteria.

1. INTRODUCTION

Education is an important part of life. The quality of forming a nation affects its progress of a nation (Hamdi, 2020; Karunasree & Francis, 2020). Without education, a nation cannot experience change and progress. Therefore, education must be prepared as a provision for life in the future. Learning problems are closely related to educational problems. Learning is one of the elements in the implementation of education. One of the efforts to improve the quality of education is the implementation of innovations or breakthroughs in the world of education, especially in learning activities that can hold certain aspects of a person so that they can achieve their maximum potential (Cahyadi, 2019; Hafa et al., 2017; Karo-Karo & Rohani, 2018).

The educational process in learning units must be designed interactively, inspiring, exciting, challenging, motivating active participation, and providing sufficient space for initiative, creativity, and

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independence by students' skills, attention, and physical and psychological development (Andrijat, 2014; Karo-Karo & Rohani, 2018). Each subject has its role in improving student skills. One of the important subjects taught in schools is mathematics. According to previous study mathematics is a branch of science that is systematic and exact (Buyung et al., 2022). Mathematics is studied at all levels of education (Crismono, 2017; Fitriani, 2014). Learning mathematics aims to develop the ability to think not only to count because mathematics also needs analysis to solve problems.

The teacher is responsible for the process of learning activities, can condition and manage student learning to achieve maximum results (Bell, 2016; Sundari et al., 2022). However, from the observations of researchers, the low understanding of mathematical concepts is caused by the teacher's role in controlling the learning process, where the teacher becomes the center of learning so students tend to be passive in learning. Not only that, but teachers also only use conventional learning models without combining them with media that attract students' interest in learning mathematics. Learning in class will affect the character and level of understanding of students (Beer & Mulder, 2020; Nuralam & Eliyan, 2017). So that if learning is student-centered, it is hoped that students will become active, creative, innovative, and better understand mathematical concepts

In line with previous study argues that learning media in general is a tool that can be used to convey messages in learning activities and stimulate students' interest in participating in the learning process (Widyawati & Usman, 2020). Other study states that there are no media created to hinder learning (Sumarsih & Mukminan, 2016). So that the use of media in a learning process can help students to be more active, increase their understanding of the material, and student achievement. The same opinion saying that media can stimulate students to be able to manipulate concepts and be able to know abstract mathematical concepts (Yudi, 2016).

Understanding the material is the main goal of learning. Learning the concept of addition and subtraction of integers at school is only taught to the extent that students know it and then given exercises without students mastering the concept of solving problems and presented with the lecture method (Hadi & Novaliyosi, 2019; Wibowo & Nilawati, 2015). Meanwhile, the concept of adding and subtracting integers is a concept that absolutely must be mastered by anyone who studies mathematics. One of the reasons why students find it difficult to learn integers is the abstract concept of numbers (Suhendri & Ningsih, 2018; Thomas & Gilbert, 2016). Apart from being abstract, another reason is that students do not master the questions, due to a lack of knowledge so students find it difficult to conclude (Novitasari, 2020; Umbara & Suryadi, 2019).

From the description above, the researcher is interested in developing counting trajectory learning media or hereinafter referred to as BELITUNG media for integer learning which can overcome various problems, namely the lack of students' understanding of mathematical concepts and the absence of appropriate learning media.

2. METHOD

The method used in this research is the research and development method. Research method is a tool for answering questions and strengthening the hypotheses made by researchers (Afandi et al., 2013; Gustiani, 2019). Research and Development (RnD) is the process of using something to develop and validate products related to education. While the Research and Development method is a research method carried out to produce a product and test its effectiveness. Research and Development describe the stages of the R&D method (Saputro, 2021; Sugiono, 2019). A research and development stage is show in Figure 1.

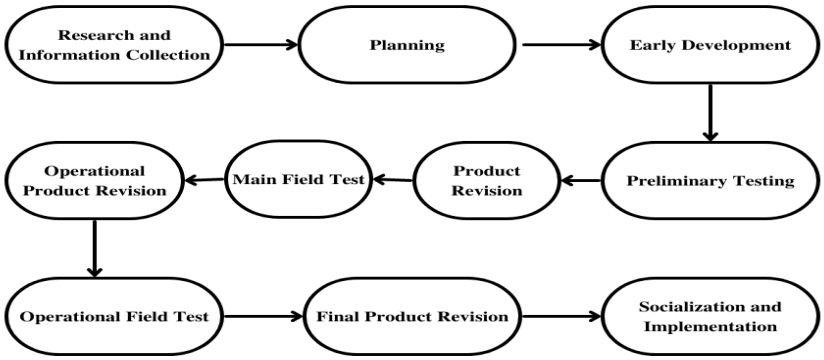

Figure 1. Research and Development Stages

Base on Figure 1, there are ten existing stages, in this study, only five stages were used which were adjusted to research needs. The stages are, 1) Research and Information Collection, 2) Planning, 3) Early Development, 4) Preliminary Testing, 5) Product Revision, and then evaluation. The development of media design in this study refers to the ADDIE model his model has five stages (Aldoobie, 2015; Wulandari et al., 2017) as show in Figure 2.

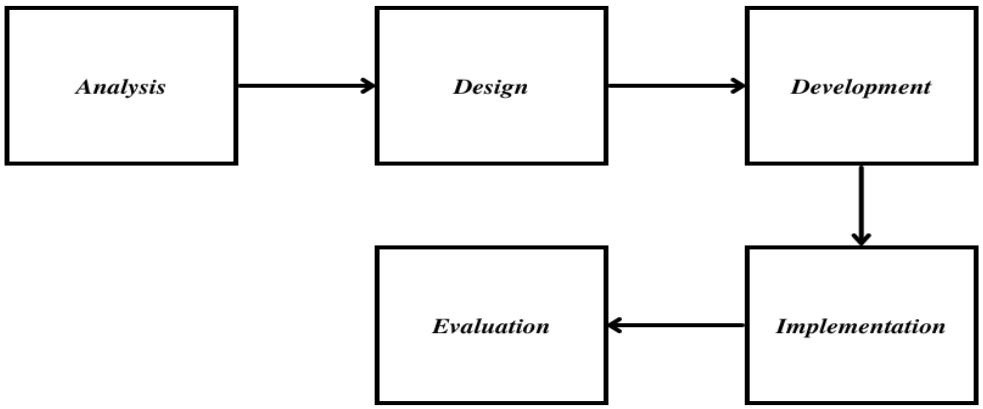

Figure 2. Stages of the ADDIE Model

The research was conducted at SD N II Drono, specifically at DK. Drono, Ds. Drono, Ngawen District, Klaten Regency, Central Java Province. The research was conducted in the 2021/2022 academic year. Respondents in this study were teachers and third-grade students.

Data collection techniques in this study are 1) Observation, to collect data by observing ongoing activities. 2) Questionnaire, which contains written questions to find out someone's opinion about a problem. 3) Interview, which aims to find out opinions by conducting question and answer. The research instruments used were 1) Interview guide, containing a list of questions to be asked of teachers and students. 2) Statement questionnaires related to the developed media. 3) Expert assessment sheet, this assessment sheet has 5 (five) alternative answers. The assessment score is given using a Likert scale.

Data analysis technique using Likert analysis. The Likert scale is used as a measure of attitudes, opinions, and thoughts (Pramuaji, 2017). The range used is written is show in Table 1.

Table 1. Likert Scale

No.	Intervals		Criteria
	In %	On a scale of 1 - 5	
1	81% – 100%	4.1 – 5	Very good
2	61% – 80%	3,1 – 4	Well
3	41% – 60%	2,1 – 3	Not good
4	21% – 40%	1,1 – 2	Not good
5	0% - 20%	0 – 1	Not very good

3. RESULT AND DISCUSSION

Result

The counting trajectory learning media or which has the acronym BELITUNG is a form of development of the counting rule media. The development that has been done is then validated. The results of the research and development were validated by experts. Exert validation result is show in Table 2.

Table 2. Expert Validation Results

No.	Rating Result	Score	Instrument Average	Category
1	Media Validation	41	4.1	Excellent
2	Material Validation	44	4.4	Excellent
3	Participant Validation	47	4.7	Excellent
	Score Average		**4.4**	

Base on Table 2, show Media Expert validation was carried out by filling out a questionnaire totaling 10 items with a rating scale of 1 to 5. The assessment result was 41, and the average score was 4.1 with a percentage of 82%, so the learning media developed has very good criteria. The media expert validator stated that the media was by the learning materials and Basic Competency. Assessment by material expert is using a rating scale of 1 to 5 with 10 statement items. The results of the assessment are 44 scores and an average of 4.4 with a percentage of 88%, so the learning media is said to be very good. According to the expert validator, media material is relevant to KI, KD, and student development. Assessment by expert practitioners, from the results of validation by expert practitioners obtained a score of 47, so the average score of the instrument is 4.7 percent 96%. If it is converted into qualitative means the media is said to be very good.

Based on the results of the assessment that has been carried out by experts, Media Development BELITUNG for Learning Integer Class III Elementary School meets excellent criteria to use. The average score obtained is 4.4 and the average percentage is 88% which, if interpreted qualitatively, means that the media is included in the "Excellent" category. So, the media is suitable use in learning. Media development was carried out in class III mathematics learning media at SD N II Drono. The research results were obtained from the assessment of media experts, material experts and practitioner experts. The stages used in the ADDIE model in developing learning media namely: *Analysis* (Analysis), *Design* (Design), *Development* (Development), *Implementation* (Implementation) and *Evaluation* (Evaluation). Here are the steps.

Analysis

The research was conducted because there were problems in the field that could be used as a benchmark for research product development. Before conducting research, it is necessary to adjust the needs of students. The results of interviews with expert practitioners said, "In teaching and learning students tend to be passive, students may need innovation in learning. Like media use. The unavailability of media provided by schools to support the learning of arithmetic operations requires teachers to be creative. “Usually students listen to the material and then work on the questions. There are no media yet, only group games are made”.

Design

This activity begins with determining the material to be included in the media, the purpose of the media, designing the shape and size of the media and designing instructions for using the media. Furthermore, researchers developed a product evaluation instrument. This instrument is in the form of validation sheets of media experts, material experts, practitioner experts and question sheets that will be used to determine student understanding.

Development

The development stage is used to design changes in existing media. This development includes media functions, displays, and content that will be presented by preparing materials and media-supporting images made by the researchers themselves. Design of Counting Trajectory Learning Media (BELIUNG) is show in Figure 3.

Figure 3. Design of Counting Trajectory Learning Media (BELIUNG)

Base on Figure 3, there are some element contain such as, rows of numbers consists of the numbers -10 to 10. The numbers can be removed to suit your needs. Question board is a place to write down the questions that will be worked on and the answers that have been obtained using the media. Then there is score board that used to write scores between individuals and groups when the media is used as a game. QR Code is made to access questions and materials. And airplane is used to show numbers and can be rotated 360 degrees. If the number is positive the plane is facing right and if the number is negative then the plane is facing left. The example of arithmetic operations on addition and subtraction numbers is show in Figure 4. Then the step taken to use Count Path media is show in Figure 5.

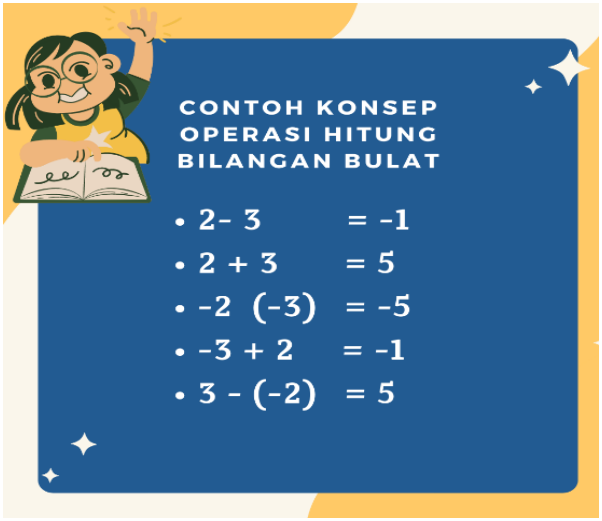

Figure 4. An Example of the Concept of Arithmetic Operation

Figure 5. How to Play Media

Implementation

At the implementation stage, trials were carried out for Counting Tracks or BELITUNG Learning Media products. Limited trials were carried out on third-grade students and assessed by a practitioner validator, namely a class III teacher. The trial was carried out with 15 students who had been divided into several small groups with 3-4 students as members. Students are given BELITUNG media as well as smartphones and then asked to access *QR Codes*. After appearing, students open the material and study it. Then students work on the questions that have been provided in groups and take turns using BELITUNG media. Furthermore, students filled out the response sheet to collect students' opinions in assessing the quality of the product being developed. The following are the results of student responses to BELITUNG media for learning addition and subtraction of integers as show in Table 3.

Table 3. Results of Student Responses to BELITUNG Media

Respondents	Total Score	Qualifying Score	Percentage	Category
1	60	4.62	92.31%	Very effective
2	60	4.62	92.31%	Very effective
3	60	4.62	92.31%	Very effective
4	57	4.38	87.69%	Very effective
5	58	4.46	89.23%	Very effective
6	58	4.46	89.23%	Very effective
7	64	4.92	98.46%	Very effective
8	57	4.38	87.69%	Very effective
9	59	4.54	90.77%	Very effective
10	64	4.92	98.46%	Very effective
11	57	4.38	87.69%	Very effective
12	57	4.38	87.69%	Very effective
13	56	4,31	86.15%	Very effective
14	59	4.54	90.77%	Very effective
15	58	4.46	89.23%	Very effective
Amount	**884**	**67.99**	**90.67%**	

Based on Table 3, the total student score is 884 with an average score of 5.54 and a percentage of 90.67 meeting the very effective criteria. Thus it can be concluded that the student's response to the development of BELITUNG media for learning the addition and subtraction of integers produced was very effective.

From the observations of researchers while testing the media, students look enthusiastic about learning, because the media has an attractive and colorful appearance. BELITUNG media is an innovation that makes it easier for students to learn to solve mathematical problems, especially in addition and subtraction.

Evaluation

Evaluation has the aim of seeing whether the media developed is as expected. The evaluation is taken from the score given by the expert validator. During the evaluation, attention was paid to criticism and suggestions from experts. Criticisms and suggestions are then used to revise the product which will then be used as a medium for learning mathematics.

Discussion

From these data, it can be concluded that the learning of mathematics, especially addition and subtraction at this school still does not have its media and the lack of students' understanding of the concept of learning mathematics makes it more difficult for students to understand the learning and the questions given. So the researchers developed a slide rule which was then called the counting trajectory learning media or BELITUNG.

The product developed in this research and development is the Counting Trajectory Learning Media or BELITUNG. BELITUNG is a learning medium that is used to make it easier for students to learn mathematics. Through media that is attractive to students, it is hoped that it will be able to help the student learning process and can build a pleasant learning atmosphere. According to previous study media is everything that is used to send messages to students so that they can stimulate thoughts, feelings, concerns and interests in such a way that the process of learning happens (Mashuri, 2019).

BELITUNG media is a learning media in the form of a board accompanied by a slide rule. Media is also equipped with *QR Codes* used to access materials and questions. The material contained is an explanation of the properties of integers and examples of their arithmetic operations. The "Land of Count" media is a square having a size of 60 cm x 60 cm, and has 2 (two) supporting legs made of thick plywood boards. This board is divided into several sections, the track section which contains rows of numbers and objects (planes) that can be shifted, the instructions section on how to use and examples of integer arithmetic operations, the *QR Code* as a question bank and score table when the media is used as a game.

To see if the developed product is suitable for use or not, product validation is needed. Product validation uses a questionnaire accompanied by a note of suggestions and criticisms for development. Media validation and expert validation were carried out by two UMS lecturers. 1) Media experts, from the results of validation by media experts, the result is 4.1. If converted into qualitative data this media is said to be very good. One of them is in KD 3.2 Understanding the location of numbers on the number line, students can demonstrate the location of numbers on the counting path and solve the problems given correctly. Components in the media can be used effectively because they have their respective uses. Like the addition of flower ornaments, besides aiming to beautify the media, it is also used as a place to place *QR Codes.* Besides being attractive, the media is also easy to use and presents material that is easily understood by students. So that the media has expertise as a source of learning and triggers student activity in learning. "BELIUNG" media has a size and appearance that is adjusted to its use as a large group scale media (one class).

There is research that is relevant to BELITUNG media. First, research uses the media in the form of a slide rule*M-Count* to assist in solving integer problems, especially subtraction and addition (Hartaningrum & Maarif, 2021). Second, regarding the development of integer arithmetic operations media (Srintin et al., 2019). This research was tested on seventh-grade junior high school students in Blora. Media is made by adding colors and ornaments that can make students interested and not bored. Third, is research use of interactive learning media in learning mathematics is one way to visualize abstract mathematical material so that students can easily understand it (Batubara, 2015).

Even though it has a fairly large size, this media is quite practical to carry in class because it can be folded into two parts. There is a suggestion given by the media validator, namely the selection of attractive colors for students. This was fixed by changing the color and background media. 2) Material experts, validation by material experts obtained a score of 4.4 which when converted to qualitative data, the media is said to be very good. According to the expert validator, media material is relevant to KI, KD and student development. The material presented is accurate and easy to understand because the sentences used are

simple. Sentences used do not cause double meanings, informative text and use communicative sentences. There are criticisms and suggestions given by the media validator and material validator. After revision, the media is feasible to be tested on students as media in learning.

The media was tried out in a limited way, the trials were carried out on third-grade students and assessed by a practitioner validator, namely a class III teacher. The score of the validator is 4.7. If it is converted into qualitative data, it means that this media has very good criteria. Practitioner expert validators agree that the media is easy to use and not easily damaged. The media is not easily damaged because it is made of thick plywood. In the limited trial, there was a suggestion from the practitioner validator to provide scoreboards individually not in groups. However, based on the results of the assessment, BELITUNG media is suitable for use by students without revision.

4. CONCLUSION

Based on the results of research and discussion, it can be concluded that Media Development BELITUNG for Class III SD Integer Learning fulfills the ADDIE research steps. Students' problems regarding understanding the concept of integer arithmetic operations can be assisted by the presence of media BELITUNG. Media is made according to the material, learning objectives and the needs of teachers and students. Based on the validation of the development of learning media BELITUNG meets very good criteria, with the conclusion that based on the stages of research that have been done, the media is considered appropriate for use in classroom learning. With this research, it is hoped that students can better understand how to solve problems regarding addition and subtraction without any mistakes which will result in the next Mathematics lesson. For teachers, BELITUNG media can create, apply and choose the right learning media so that they can develop students' abilities to solve math problems by the material being taught.

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