
| RESEARCH ARTICLE

Implementation of Teacher-Made Mathematics Learning Media on Integer Counting Operations

Armin Haluti¹ ✉ Hamzah B. Uno², Nurhayati Abbas³, Ismail Djakaria⁴, Syamsu Qamar Badu⁵, Arwildayanto⁶ and Novianty Djafri⁷

¹Department of Physical Health and Recreation Education, Universitas Muhammadiyah Luwuk, Luwuk, Indonesia

²³⁴⁵Department of Mathematics Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Gorontalo, Gorontalo, Indonesia

⁶⁷Department of Educational Management, Faculty of Education, Universitas Negeri Gorontalo, Gorontalo, Indonesia

Corresponding Author: Armin Haluti, **E-mail:** arminhaluti.umluwuk@gmail.com

| ABSTRACT

This study aims to identify the teacher-made mathematics learning media on integer arithmetic in elementary school. Employing a quantitative description approach with descriptive statistics for data analysis, this study obtained the data from tests and interviews. The result revealed that from 12 students who were given the test, there were 11 students who obtained above minimum mastery criteria set by the school, which is 75 or 91.6% of students who completed. Additionally, classical completeness reached 86.6%, above the provisions. All in all, teacher-made media is particularly effective in building up student's learning outcomes in primary school.

| KEYWORDS

Implementation, Teacher-Made Media, Integer

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1. Introduction

Curriculum development is underlain by national educational standards to achieve national educational goals. The elementary school curriculum is created on the basis of Permendikbud, 2018. Permendikbud curriculum aims to develop four competencies, including spiritual attitudes, social attitudes, knowledge, and skills. Thus, in order to build competencies, particularly knowledge and skills, the purpose of the material itself should be comprehended, such as integer counting operations.

The aim of math subject's integer arithmetic is to aid elementary school students with arithmetic operations that can be applied in daily activities. The ability to perform arithmetic will help learners in adapting and socializing with the community environment as well as will be easier to do the task given by the teacher.

The ability to perform arithmetic in mathematics can be acquired if the teaching process is carried out as early as possible, gradually, and continuously through the utilization of good and appropriate learning media. The use of media in learning aims to facilitate learners in understanding the material, particularly in integer arithmetic. However, there are no media or instructional mathematics tools to boost students' interest and passion for learning to the present day. According to (Wahyudi, 2018), one of the factors that determine the success of mathematics learning is the learning media employed. Learning media can help students understand abstract mathematics. In accordance to (Yuliardi, 2019), multiplication by using a collection means that multiplication is done with the help of similar simple objects. Based on the study rationale, researchers strive to use teacher-made media in math learning, especially in the subject of integer counting operations.

As a matter of fact, it revealed that students still lack understanding in learning mathematics in elementary school related to the material of integer arithmetic that merely conventional media in the form of books or blackboards. In addition, a lack of teacher

motivation in the learning process causes students to be less active, as well as a lack of students who complete integer counting operations. This study will examine the extent of students' knowledge in completing the operation count integers after being taught using mathematics learning media made by teachers through analysis and description of learning test results, which will be compared to the completion of learning operations count integers result. Further, students are expected to be able to solve the problems in the material operations count integers well.

2. Literature Review

2.1 Study of Mathematics Learning

Mathematics is a universal science that underlies the development of modern technology, plays an essential part in various disciplines, and can develop human imagination and thinking skills. The development of mathematics in the fields of algebraic number theory, logic, and discrete mathematics has influenced today's development, particularly in the field of information and communication technology in the era of the Industrial Revolution 4.0. According to (Yuliardi, 2019), mathematics has been acknowledged as a measure of one's intellect level, which is in line with the characteristics of mathematics as a science that is deductive, logical, axiomatic, symbolic, hierarchical systematic, and abstract. According to (Tombokan 2014), mathematics is the study of patterns and relationships, the mindset with organizational strategies, analysis, and synthesis, art, language, and tools to solve abstract and practical problems. In line with (Fakrul, 2018) expressed that mathematics is not just a lesson about numbers or how to count but also about organizing the way of thinking, particularly in the formation of analytical skills, synthesis, and evaluation abilities, as well as problem-solving skills.

Based on the preceding statement, mathematics is the science that underlies technological advancement. Therefore, all students should be taught mathematics; thus, students are able to think logically, analytically, methodically, axiomatically, sembolically, abstractly, practically, critically, and creatively, as well as being able to evaluate and collaborate to solve problems in everyday life.

2.2 Basic Concepts of Integer Count Operations

Basic arithmetic operations concepts are the underlying concepts of basic arithmetic operations that include addition, subtraction, multiplication, and division (Purnomo, 2014). Learning Concepts is an important element in school learning, especially in mathematics. Mastery of multiple concepts allows one to solve problems more effectively.

There are two types of mathematical knowledge in mathematics education those are conceptual knowledge and procedural knowledge. Conceptual knowledge is knowledge full of ideas. It can also be defined as a collection of unified points with relationships in it. Further, conceptual knowledge is more than just a single idea. As Hibert and Carpenter stated that knowledge of concepts is "knowledge comprehended." (John, 2008)

2.3 Study of Learning Media

Teaching tools are important in teaching and learning activities for the reason that they can help students understand the subject better, thus eliminating verbalism in the learning process. Additionally, the use of teaching tools by teachers helps students absorb the material more quickly. According to (Elly, 1994), teaching tools are learning media that contain or convey the characteristics of the concept learned. As stated by (Sukayati, 2009), teachers utilize teaching tools to make the process of teaching and learning of students more effective. Meanwhile, according to (Sudjana, 2009), educational teaching tools are an instrument that can easily be accepted with the aim of helping teachers to make the learning process of students more effective and efficient. Teaching aids are a tool used to assist in the teaching and learning process that plays a major role as a support for learning activities conducted by teachers. The use of teaching aids aims to provide a tangible form of the material being taught.

Based on experts' statements above, it can be concluded that teaching tools are media that are easily accepted in explaining concepts of learning from abstract material to real life. Hence, students' learning process is more effective and efficient in stimulating the mind, feelings, attention, interest, and motivation. Teaching tools are instruments used to aid in the teaching and learning process. It plays a major role as a support for teacher learning activities which aims to provide a tangible form of the abstract materials.

3. Methodology

This research is included in quantitative description research which examines conditions or other factors associated with the use of learning media and presents the findings in a research report (Arikunto S., 2015). This study was conducted from September to December 2021 in Class VI of the 2021/2022 academic year at Elementary School State Inpres Bunga, North Luwuk District.

The study's main data is on students' ability to solve problems in the operation of counting integers utilizing math learning media made by teachers. Two classes from Class VI Elementary School State in Inpres Bunga, District Luwuk Utara, are used as the population. Employing purposive sampling, students are grouped based on the distance of the nearest house, considering the rise of covid-19. Thus, there are 12 students in total as a sample of the research subjects.

The variable in this study is the ability of students to solve the problem of integer arithmetic using teacher-made media. Those are: (1) Addition operations; (2) Subtraction operations; (3) Multiplication operations, and (4) Division operations.

Instruments such as essay tests and interviews were used to collect data. According to (Suharsimi, 2010), an essay test is used to measure something that is important and certain; meanwhile, the interview is used to complete the information of the test results. The study used the essay test to measure students' learning outcomes in completing operations of calculating integers using mathematics learning media made by teachers, while the interview is used to acquire information regarding the difficulty of students in completing the test.

After completing the learning process utilizing teacher-made media on the integer counting operation material, elementary school students in Grade VI are given a test of their mathematics learning results, particularly the integer multiplication counting operation material. In order to determine the effectiveness of the use of mathematics learning media made by teachers, researchers used the score acquired by students and the minimum completeness criteria in school, which is 75% for mathematics subjects, and classical 85%, which is based on Permendikbud RI number 37 of 2018. (Permendikbud, 2018)

3.1 Data Reduction

- a. Examining the result of students' work on the essay test after the implementation of media of teacher-made mathematics by looking at the extent of students' ability to solve the problem of calculating integer operations.
- b. Recording the results of interviews with students about the test results obtained.
- c. Analyzing the data in the form of students' ability to solve the problem of integer counting operations.

3.2 Data Presentation

The data presented are in the form of students' ability to work on integer arithmetic which is the result of the implementation of teacher-made mathematics learning media. It applied percentage analysis which will be done on each problem on the type of integer counting operation. The following is the formula to determine the percentage of the type of operation count integers (Tatu, 2021):

$$\text{Student ability} = \frac{\text{total score obtained}}{\text{maximum}} \text{ score} \times 100\%$$

Next, student scores will be determined based on the type of problem in the integer counting operations, including addition operation, subtraction, multiplication, and division.

3.3 Conclusion Drawing

Following the presentation of data, the next step is to draw conclusions in accordance with the research purposes of determining students' abilities to solve the problem of calculating integer operations using mathematics learning media made by teachers.

4. Results and Discussion

4.1 Research Results Description

Table 1. Student Learning Outcomes

Respondents	Value										AMOUNT
	1	2	3	4	5	6	7	8	9	10	
1	5	5	5	10	10	5	15	15	15	15	100
2	5	5	5	10	10	5	15	15	15	15	100
3	5	5	5	10	10	5	3	15	15	15	87
4	5	1	1	10	10	5	15	15	15	15	93
5	5	5	5	10	10	5	15	3	15	15	88
6	5	5	5	10	10	5	15	15	15	15	100
7	5	5	5	10	10	5	15	15	15	15	100
8	5	5	5	10	10	5	15	15	15	3	88
9	5	5	5	10	10	5	15	15	15	15	100
10	5	1	1	10	5	1	15	15	3	3	58
11	5	5	5	10	10	5	15	15	15	3	88
12	5	5	5	10	2	5	15	15	15	15	92

The purpose of this study was to determine student learning outcomes through the use of mathematics learning media made by teachers, as evidenced by the results of an essay test on integer calculating operations and student interview data. Based on the test results, the number of students who completed the problem of calculating the integer was 11 people, which is in compliance with the minimum mastery criteria, and 1 student who had not completed or less than 75. The details are as follows:

Respondent 1

From 10 questions given, obtained minimum completeness criteria as follows

$$\text{Minimum Mastery Criteria (KKM)} = \frac{100}{100} \times 100\% = 100\% \text{ (complete)}$$

Respondent 2

From 10 questions given, obtained minimum completeness criteria as follows

$$\text{Minimum Mastery Criteria} = \frac{100}{100} \times 100\% = 100\% \text{ (complete)}$$

Respondent 3

From 10 questions given, obtained minimum completeness criteria as follows

$$\text{Minimum Mastery Criteria} = \frac{87}{100} \times 100\% = 87\% \text{ (complete)}$$

Respondent 4

From 10 questions given, obtained minimum completeness criteria as follows

$$\text{Minimum Mastery Criteria} = \frac{93}{100} \times 100\% = 93\% \text{ (complete)}$$

Respondent 5

From 10 questions given, obtained minimum completeness criteria as follows

$$\text{Minimum Mastery Criteria} = \frac{88}{100} \times 100\% = 88\% \text{ (complete)}$$

Respondent 6

From 10 questions given, obtained minimum completeness criteria as follows

$$\text{Minimum Mastery Criteria} = \frac{100}{100} \times 100\% = 100\% \text{ (complete)}$$

Respondent 7

From 10 questions given, obtained minimum completeness criteria as follows

$$\text{Minimum Mastery Criteria} = \frac{100}{100} \times 100\% = 100\% \text{ (complete)}$$

Respondent 8

From 10 questions given, obtained minimum completeness criteria as follows

$$\text{Minimum Mastery Criteria} = \frac{88}{100} \times 100\% = 88\% \text{ (complete)}$$

Respondent 9

From 10 questions given, obtained minimum completeness criteria as follows

$$\text{Minimum Mastery Criteria} = \frac{100}{100} \times 100\% = 100\% \text{ (complete)}$$

Respondents 10

From 10 questions given, obtained minimum completeness criteria as follows

$$\text{Minimum Mastery Criteria} = \frac{58}{100} \times 100\% = 58\% \text{ (incomplete)}$$

Respondents 11

From 10 questions given, obtained minimum completeness criteria as follows

$$\text{Minimum Mastery Criteria} = \frac{88}{100} \times 100\% = 88\% \text{ (complete)}$$

Respondents 12

From 10 questions given, obtained minimum completeness criteria as follows

$$\text{Minimum Mastery Criteria} = \frac{92}{100} \times 100\% = 92\% \text{ (complete)}$$

Integer count operation test result can be seen in the following table.

Table 2. Integer Count Operation Test Result

Category	Interval Score	Frequency	Percentage (%)
Excellent	85 – 100	11	91,6
Good	65 – 84	0	0
Enough	55 – 64	1	8,4
Low	35 – 54	0	0
Very Low	0 – 34	0	0
Total		12	100

Based on the frequency distribution, there were 11 respondents (91.6%) with excellent learning outcomes and 1 respondent (8.4%) with good learning outcomes among the 12 students that were selected as respondents. This suggests that the majority of the 12 students who took the exam had very high learning outcomes, leading to the conclusion that the results of the math learning test using teacher-made media are generally high and very high outcomes (91.6%). An overview of the test results can be seen in the figure below.

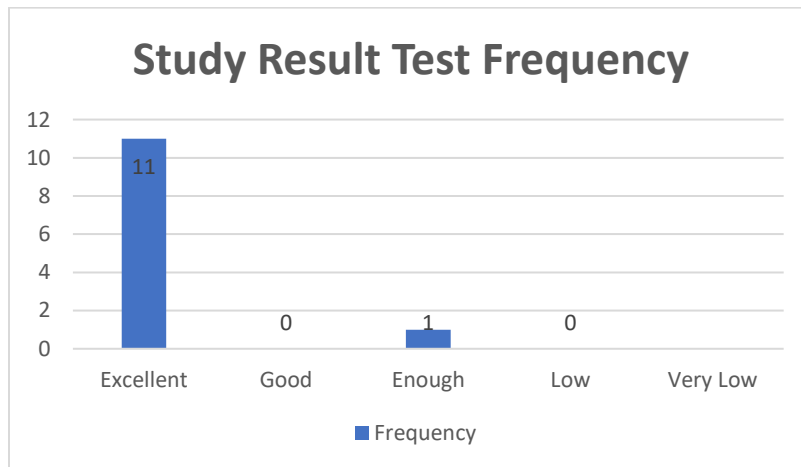


Figure 1. Study Result Test Frequency

4.2 Research Description by Types of Arithmetic Operations

4.2.1 Addition Operations

In the addition operations, there are 3 items of the questions, namely the sum of positive numbers, positive and negative numbers, as well as negative and negative, which obtained:

- Question number 1: From 12 students who worked on the questions, all of them answered correctly, or 100% of students managed to solve the problem.
- Question Number 2: From 12 students who worked on the questions, there were 2 students who answered incorrectly or 16.6%, and 10 students who answered correctly or 83.4%
- Question Number 3: From 12 students who worked on the questions, there were 3 students who answered incorrectly or 25%, and 9 students who answered correctly or 75%

From the arithmetic addition operation result, if it is averaged, it will achieve complete learning, as follows:

$$\text{Student ability} = \frac{164}{180} \times 100\% = 91.1\% \text{ (completed)}$$

4.2.2 Subtraction Operations

In the subtraction operations, there are 2 questions which the sum of positive numbers, positive and negative numbers that were acquired:

- Question number 4: From 12 students who worked on the questions, all of them answered correctly, or 100% of students were able to solve the question.
- Question Number 5: From 12 students who worked on the questions, there were 2 students who answered incorrectly or 16.6%, and 10 students who answered correctly or 83.4%

From the arithmetic subtraction operation result, if it is averaged, it will achieve complete learning, as follows:

$$\text{Student ability} = \frac{227}{240} \times 100\% = 94.6\% \text{ (completed)}$$

4.2.3 Multiplication Operations

In the multiplication operation, there are 3 questions, including the addition of positive numbers, positive and negative numbers, as well as negative and negative, which are obtained:

- Question number 6: From 12 students who worked on the questions, there was 1 student who answered incorrectly or 8.4%, and 11 students who answered correctly or 91.6%
- Question Number 7: From 12 students who worked on the questions, there was 1 student who answered incorrectly or 8.4%, and 11 students who answered correctly or 91.6%
- Questions Number 8: Obtained from 12 students who worked on the questions, there was 1 student who answered incorrectly or 8.4%, and 11 students who answered correctly or 91.6%.

From the arithmetic addition operation result, if it is averaged, it will achieve complete learning, as follows:

$$\text{Student ability} = \frac{392}{180} \times 100\% = 93.3\% \text{ (completed)}$$

4.2.4 Division Operations

In the operation of a division operation, there are 2 questions that are the sum of a positive number and those obtained:

- Question number 9: From 12 students who worked on the questions, there was 1 student who answered incorrectly or 8.4%, and 11 students answered correctly, 11 students or 91.6%.
- Question Number 10: There were three students who answered incorrectly (25%) and nine students who replied correctly (75%) among the 12 students that worked on the questions.

From the arithmetic subtraction operation result, if it is averaged, it will achieve complete learning, as follows:

$$\text{Student ability} = \frac{312}{360} \times 100\% = 86.6\% \text{ (completed)}$$

When viewed from classical completeness based on the type of integer arithmetic after learning using teacher-made mathematics learning media, it can be stated classically complete if it's above 85%. The details about the level of student learning outcomes based on operation count integers can be seen in the diagram below.

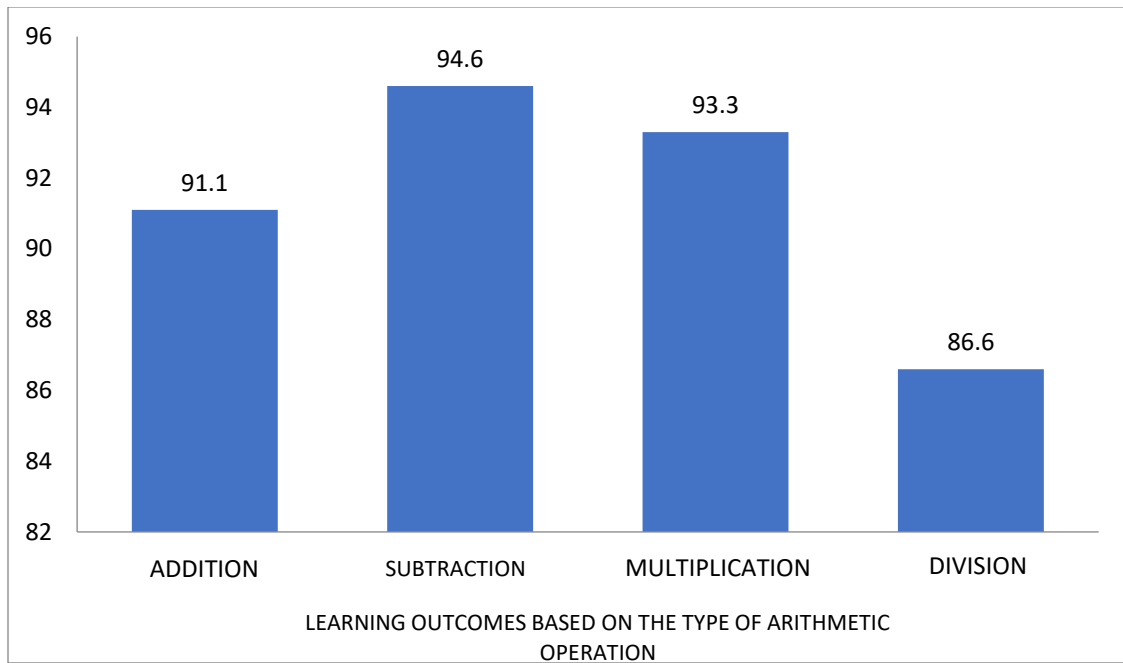


Figure 2. Learning Outcomes based on the Type of Arithmetic Operation

Based on the result obtained, students have an understanding of how to solve the problem of calculating operations using mathematics learning media made by teachers, as in the following questions:

1. Determine the result of $2 + 3 = ?$
 Media Implementation
 - a. Students prepare a solution box provided by the teacher
 - b. Learners take 2 white triangles and place them in the solution box



Figure 3. Solution box

- c. Because the addition of both numbers is positive, the students take back three white triangles and place them in the solution box.



Figure 4. Solution box

- d. Learners calculate the entire triangle inside the solution box. Thus, the result of $2 + 3 = 5$

2. Determine the result of $-5 + (-7) = ?$
 Media Implementation

- a. Students prepare a solution box provided by the teacher
- b. Learners pick 5 red triangles and place them in the solution box

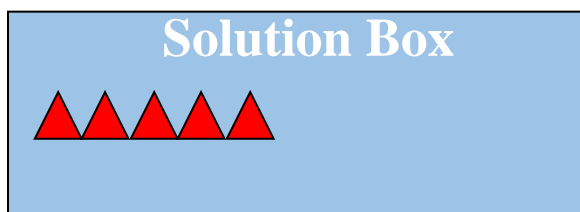


Figure 5. Solution box

- c. Because the addition of both numbers is negative, the students must take back seven red triangles and enter them into the solution box.

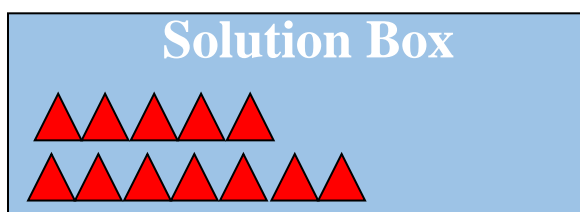


Figure 6. Solution box

- d. Learners calculate the entire triangle inside the solution box. Thus obtained $-5 + (-7) = -12$
- e. Students convert ten red triangles into one red square since the total of the two numbers produces tens.



Then obtained $-5 + (-7) = -12$



The data obtained showed the ability of students to solve the problem of integer arithmetic using mathematical learning media through integer arithmetic tests or through the level of individual completeness, as shown by the data described in the research results above.

5. Conclusion

The study aims to identify the teacher-made mathematics learning media on integer arithmetic in elementary school. The results show that student learning results in using teacher-made mathematics learning media on integer count operations are categorized as very high. This is shown in the percentage of individual completeness of 12 respondents. There are 11 respondents who completed or achieved a value above KKM, which is 75, while classical completeness obtained a value of 86.6% or above the classical KKM, which is 85%. This study was only limited to integer arithmetic learning in elementary school. Therefore, it is important to conduct future research on a different topic.

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