



# Analysis of the Use of Manipulative Media to Understand Mathematical Concepts Elementary School Students

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**Abstract.** This study aims to analyze the use of manipulative media on elementary school students' understanding of mathematical concepts. This research method uses literature review, which is a method by reading and recording and managing research material and then concluding research material. Sources of research data are in the form of books, journal articles both nationally and internationally. The results of several studies that we reviewed show that the use of manipulative media helps elementary school students understand mathematical concepts.

**Keywords:** Manipulative Media, Mathematical Concepts, Cognitive Development.

## 1. INTRODUCTION

Mathematics is a very important subject to be studied at all levels of education, from early childhood education to college. In some countries in the world mathematics is one of the core subjects in primary, secondary, and higher education. Mathematics learning is introduced to children from an early age because mathematics is needed to develop children's way of thinking so that they can solve everyday problems. Mathematics can provide provisions in the form of logical, analytical, systematic, critical and creative thinking skills, as well as the ability to collaborate. At first glance, the math concepts taught to elementary school students seem simple and easy. However, accuracy is needed when presenting these concepts so that students can understand them well.

Mathematics can develop critical and analytical thinking skills, because mathematics lessons are an eye-opener for all sciences not just counting and measuring. The main objective of learning mathematics is the involvement of students in the process of discovery of mathematical ideas and the process of

formulation. One interesting concern about learning maths is developing a mind to solve problems that require higher-order thinking skills. These problems and puzzles arouse curiosity and challenge individual intelligence. Introducing problem solving into the classroom improves students' skills and their ability to think creatively, logically and carefully. Problem solving in mathematics as an important aspect, and becoming a necessity in mathematics curricula around the world [1]. Therefore, mathematics as a basic science needs to be mastered well by students, especially since elementary school age [2]. Almost all lessons in elementary school are related to mathematics, therefore the allocation of time for mathematics subjects is given quite a lot compared to other subjects. Mathematics has an important role in equipping students with the ability to think logically, analytically, systematically, critically, and able to utilize information to survive in ever-changing, uncertain, and competitive circumstances [3]. Mastery of material that is still very lacking is one of the obstacles in learning mathematics in Indonesia. This is reflected in the low achievement of Indonesian students at the international level. According to an international survey conducted by PISA (*Programme for International Student Assessment*) (Tohir, 2019) shows that Indonesian students' mastery of mathematics is ranked 73rd out of 79 countries. Mastery of mathematics is measured through the learning outcomes achieved by students [4]. From the results of the PISA survey, it can be seen that the mathematics ranking of Indonesian students is relatively low compared to other countries. The results of the Indonesian Student Competency Assessment (AKSI)/Indonesia National Assessment Program (INAP) which measures reading, math, and science skills for elementary school children also showed similar results. Nationally, for the category of less in mathematical ability as much as 77.13 percent, less in reading 46.83 percent, and less in science 73.61 percent [5].

The low achievement of students in learning mathematics is caused because the material obtained by students is still oriented to abstract things and has not met the characteristics of student development which, according to Jean Piaget, elementary school-age children are in a concrete operational period [6]. In addition, the low learning outcomes of students are also caused by the absence of the use of creative and innovative learning media so that students' understanding of the material is not optimal [7].

The obstacles or difficulties in learning mathematics in elementary schools are still the assumption that mathematics is the most feared and difficult subject compared to other subjects. In line with the article written by Puspita, et al (2017) [8] that students consider mathematics to be nothing more than calculating, playing with formulas, rules that do not make sense, and cannot be applied in everyday life. This often results in students being reluctant or not interested at all in learning maths [8]. Students think mathematics is a difficult subject, because the material tends to be abstract [9]. So that students tend to feel bored, bored, and lazy when learning takes place. This is because the stimulus or stimulation that students receive to mathematics subjects is an unpleasant stimulus, so students have the perception that mathematics is unpleasant [8]. In the learning they have done so far, students only accept what the teacher presents without thinking, so that students' abilities in learning mathematics are not so optimal.

To achieve good learning outcomes is certainly not easy, teachers as educators play a big role in the learning process. One solution that can be done is the use of learning media. In this study, the media to be used is manipulative media. According to manipulative media (Rosmalina, 2018: 3) is a learning device in the form of physical objects that can be manipulated, modeled, and demonstrated mathematical concepts and processes [10]. Kennedy (1986:6) defines manipulatives as objects that appeal to multiple senses and that can be touched, moved, rearranged, and manipulated by children [11]. Based on the description above, in this case the research aims to compile and describe a study on how the use of manipulative media on the understanding of mathematical concepts of elementary school students.

## **2. METHOD**

The approach in this study uses the type of research in the form of literature studies or literature studies. According to Snyder (2019), literature review is a research method that intends to collect and draw conclusions or the essence of existing research and analyze some expert opinions written in the text [12]. In this research, it was carried out by examining theories that are relevant to research-related problems. The data collected in this study were sourced from (1) journals, (2) articles, and (3) books.

### 3. RESULTS AND DISCUSSION

Mathematics is one of the fields of study that exists at all levels of education, from elementary school to college. This encourages the achievement of national education goals and fosters industrial, creative, and innovative Indonesian people [13]. However, mathematics is a subject that is considered difficult and confusing for most students, especially elementary school students. Therefore, mathematics learning in elementary school needs more attention because it is the basis of mathematics learning and occurs during elementary school [14]. Mathematics learning is abstract, so mathematics learning must be carried out in a way that is fun, interesting and easy to understand by students. One solution to the above problem is that learning is carried out using manipulative media. According to Yensy (2021), manipulative objects are one of the media that can attract students to be actively involved in learning [9]. Using manipulative objects (props) can make it easier for students to learn mathematics, in addition to the ability to recognize, understand, apply mathematical concepts, procedures, principles and ideas, the ability to solve mathematical problems, the ability to reason mathematics, and the ability to make mathematical connections.

Based on research conducted by Isnaniah and Imamuddin (2020) entitled *Students' Understanding of Mathematical Concepts Using Manipulative Learning Media in Elementary Schools*. This research was conducted in grade IV SDN 02 Koto Tengah on addition and subtraction of integers using manipulative media in the form of colored cardboard designed into rectangular shapes. The results of the study found that learning mathematics using manipulative media can increase students' understanding of mathematical concepts. This can be seen from the comparison of the pretest value of 83.3 with the posttest value of 95.8. Students are first given pretest questions. Pretest is given before treatment, with the aim of knowing the student's initial knowledge related to his ability to understand the mathematical concepts of addition and subtraction of integers. Then an explanation of the material with the help of media that has been prepared after which students are given posttest questions to find out the final knowledge after being given treatment [15]. In line with research conducted by Yulijayanti (2021) that based on the validation of media experts, it is known that manipulative media products are included in the good category with an average score of 87%, while material experts are also included in the good category with an average score of 85%. From the

results of student responses, data were obtained with the average percentage of responses to manipulative media reaching 90% with a very good category [16]. From the results of the study, it can be concluded that the manipulative media products developed are feasible and good in terms of media and material. So that the development of manipulative media in mathematics learning can understand the concept of addition and subtraction of integers in grade VI elementary school.

It can be concluded that students' understanding of mathematical concepts is of high value with the help of manipulative media in the learning process. Another study conducted by Anggoro (2019) showed the ability to understand mathematical concepts in cycle I of 62.5% with good criteria and in cycle II of 78.1% with good criteria. This result is better than the pretest result which was only 53.1% [17]. It can be concluded that the ability to understand mathematical concepts increases after the application of learning using manipulative media. This is also supported by Kania's research (2018) that the understanding of the concept of fractions of students who get mathematics learning using manipulative objects is better than the understanding of the concept of fractions of students who get mathematics learning with conventional learning [18].

The use of manipulatives makes it easier for students to understand mathematical concepts and procedures. This manipulative medium serves to simplify difficult concepts, present relatively abstract material to be more real, explain definitions or concepts more concretely, explain certain properties related to calculations (operations), properties of geometric shapes and show facts. Manipulative media is a concrete model that can be touched, moved by children, which serves to help children understand various mathematical concepts. Besides being able to help mathematical concepts in fractional material and addition and subtraction of integers, manipulative media can also help understand the concept of multiplication in students. Like research conducted by Nugroho, et al (2022) that the use of manipulative media has proven effective in helping to improve the ability to understand the concept of multiplication, this is evidenced by the results of the N-gain score test showing that the average N-gain score for the experimental class is 0.68 or 68% included in the category of quite effective [19]. Manipulative media can also help in improving students' math scores. as in Ligget's (2017) research that students' posttest scores in the manipulatively treated group were 18% higher than the test scores of participants in the untreated group. This study shows that the use

of manipulative media can improve children's math learning scores and achievement [20].

According to Bruner, mathematics learning will be successful if the learning process is directed at understanding concepts and knowledge of the procedures contained in the material taught. Because without understanding, students cannot apply processes, concepts or procedures. Conceptual understanding of mathematics will help and become the initial capital of students in solving mathematical problems [21]. Students are said to understand if they can construct meaning from learning messages, both verbal, written (verbal) and graphic (non-verbal), conveyed through learning, books or others [22]. Understanding the concept is closely related to students' interest in learning [23]. Learning mathematics is a process that involves ideas, ideas, rules, or relationships that are arranged logically. Therefore, in studying mathematics one must acquire understanding, because understanding is the ability to grasp the meaning and meaning of the material studied. Teachers must also carry out various activities in learning such as forming groups, discussing, and providing opportunities for students to write individually [24].

Indicators of understanding mathematical concepts include a) restating concepts that have been learned; b) objects are classified on the basis of whether or not the requirements that make up the concept are met; c) identify the properties of operations or concepts; d) apply the concept logically; e) give examples or counter examples (*not* examples) of the concepts studied; f) present the concept in various forms of mathematical representation (tables, graphs, diagrams, sketches, mathematical models, or other means); g) relate various concepts in mathematics as well as outside mathematics; h) develop necessary conditions and/or sufficient conditions of a concept [25].

Students who are at the elementary school education level are generally in the concrete operational phase. In this phase students have the ability to think to operate logical rules, but still with concrete objects. According to Martiasari (2022), grade V students can already know mathematical symbols, but still cannot deal with abstract things, children's cognitive skills such as classification, reversibility, asosisiativity, identity and seriation [26]. Thus, students need tools such as learning media to facilitate the delivery of material delivered by the teacher. The selection and use of appropriate media can attract students' attention to learning. The action is through the use of manipulative media, which are objects that can be seen,

touched, heard, felt, and manipulated so that students can immediately feel direct learning. Syamsuddin (2018) revealed that manipulative materials are materials that can be manipulated by hand, rotated, held, turned over, moved, arranged, or arranged or cut into pieces [27]. In this case, the manipulative function is to simplify difficult or difficult concepts, present relatively abstract material to be more real, explain notions or concepts more concretely, explain certain properties related to calculation work and geometric properties and show facts.

Students are considered to understand concepts if they are able to define concepts, identify and give examples, and develop mathematical relationships between different ideas, understand how mathematical ideas are related to each other so that a thorough understanding is built, and use mathematics in contexts outside mathematics. Thus, understanding concepts in mathematics learning is very important. Because understanding concepts is the main competency that students must have in learning further mathematical concepts.

#### 4. CONCLUSION

Based on the explanation above, it can be concluded that mathematics learning will be successful if the learning process is directed at understanding the concepts and knowledge of the procedures contained in the material taught. One way to teach students to understand mathematical concepts is to use manipulative media. Manipulative media play a role in simplifying difficult concepts, presenting relatively abstract material to be more real, explaining definitions or concepts more concretely, explaining certain properties related to calculations (operations), properties of geometric shapes and showing facts. The use of manipulative media helps students understand mathematical concepts, ranging from fractional material, addition and subtraction of integers, multiplication, and can increase the value and prestige of learning mathematics.

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