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Concrete Media to Increase Activities and Cognitive Learning Outcomes of Addition and Subtraction

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ABSTRACT

In order to improve cognitive thinking skills and the student's learning activities concerning mathematics, specifically on addition and subtraction topics, concrete media is employed in this research. The research was conducted as a Classroom Action Research (CAR) in the form of the Kemmis & McTaggart model and targeted at grade II students of SDN 184/V Parit Ponco, Jambi Province, with seven participants. The implementation of research is confined to the following four phases, i.e., planning and action, observation, and reflection, with a focus on the fact that some observation is done simultaneously with action. The application of such tools as colorful pictures, sticks, and real objects enabled the students to picture and physically interact with quite abstract objects in mathematics. This enhanced their interest and understanding of the subject matter. The results have shown improvement in learning outcomes and the level of student activity across cycles. The average score of cognitive outcomes, which was 32.86 in the pre-cycle, has improved to 45.71 in cycle I and 75.71 in cycle II. Similarly, students' level of learning activity increased from 39.16% in pre-cycle to 75.23% in Cycle I and 87.39% in Cycle II. Concrete media, such as its interactive and practical aspects, worked well with different learning preferences in the classroom and served to call for active participation, teamwork, and self-directed problem-solving. This method also puts to practice the fact that linking theory to practice helps students to understand and remember better because it becomes clear and concrete and facilitates the notion that learning should be purposeful, cognitive, and contextualized for the student so that learning can be long-lasting and meaningful. From this research, it is evident that concrete media can help in improving elementary education and can be utilized in other learning environments.

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1. INTRODUCTION

The development of science and technology requires humans to be able to master information and knowledge [1]. This ability requires humans to have logical, creative, critical, and systematic thinking. Therefore, it is important to cultivate the ability to think like that from an early age in students. Here, we

need to adjust the essential skills to be imbibed and inherited to adapt effectively to the modern work and business environment which is witnessing transformation due to the rapid influx of scientific and technological developments. The former dimension of education was proficiency in the language, while Mastery of Information as a fundamental skill includes interpretation, intelligence analysis, and determining the best way to deal with a situation whilst at the same time considering all factors in society, including military, business, personal development, and many others. In the same perspective, if being informed of one's surroundings is vital, knowledge provides the tools for dealing with it, for example, in the form of understanding the principles of new technology and developing requisite thinking toward creative solutions to pressing issues. The tendency to comprehend more and more information is driven, in turn, quite naturally. Advanced toward a quick pace of modern science and technology is a necessity to reach through. Such and similar skills help to succeed and develop as a person and society. Those lacking or devoid of such skills and ideas, run the risk of becoming and remaining subservient in a world where possession and usage of information will dictate movement and growth. Like the nature of education, which is an effort to make humans better [2]. One of the subjects that train thinking skills is mathematics.

Mathematical abilities are important to master, considering that mathematics is used in various scientific fields [3] and is needed in solving various problems in everyday life. These problems are especially quantitative problems that require manipulation of mathematical equations or problems that need to be solved with algorithms [4]. At all levels of education, mathematics is one of the important lessons that must be conveyed to students [5]. However, most students feel that mathematics is a difficult and frightening subject [6]–[10]. This requires educators and researchers to continue to make improvements to the learning process.

In learning elementary mathematics, lower-grade students often experience difficulties in carrying out addition and subtraction operations, as was found in the observation activities at SDN 184/V Parit Ponco. This is caused by the teacher's learning, which seems stiff, so students find it difficult to understand the explanation given by the teacher. In addition, students are also less active in learning. This is due to the monotonous learning process, which makes learning seem boring. In fact, teachers should play an important role in creating quality learning in the classroom [11].

Students from lower classes often face obstacles in performing addition and subtraction operations. This can be attributed to some developmental as well as some instructional factors. Here, many cognitive processes are still developing, and abstract ideas like number relations and borrowing or carrying of figures in multi-figure operations can be troublesome to many. Also, a lack of basic skills like number sense and simple counting skills may limit their efficiency in carrying out these operations. Such a problem also arises from what is being taught since students may focus too much on the step when the task should be implemented in case of light memorization and not enough on comprehension of relations, making it hard to understand why it fits into the context. Other reasons may include not enough practice or the absence of fun, hands-on activities, which can result in low confidence and willingness, thus making it even more difficult to solve these issues. It is necessary to include certain methods in the teaching process to alleviate the above-mentioned issues. Students need to be able to use concrete and visual materials together with interactive methods of learning, which should also increase students' interest and confidence in mathematics.

Now, researchers and observers of education are focusing more on what students learn and how students learn [12]. In the learning process, students are required to master the concept well. To be able to teach concepts properly, teachers must pay attention to child development factors. This is one of the competencies that the teacher must master [13]. The implication in learning that must be done in general is that teachers carry out learning as much as possible by taking into account the physical, motor, and perceptual development of children. For example, providing direct experience, learning through games, and learning that can facilitate students to be able to take advantage of all the senses they have [14].

To minimize these problems, learning media are needed to facilitate students' understanding of mathematics in a more real way. This is because the development of students' abstraction abilities is still weak. With concrete learning media, it is hoped that students can carry out learning activities in a fun, non-rigid way while playing. By learning while playing, the learning process carried out can balance the learning topics and the interests of students [15]. Play with learning media seems to elicit higher engagement in students and motivation to perform other activities due to intrinsic motivation towards topics associated with them. This strategy also permits the incorporation of educational material into leisure time activities, enhancing the assimilation of difficult concepts and making them more applicable. Furthermore, the incorporation of games in the learning process also nurtures creativity and critical skills, as students are invited to engage with ideas without constraints. Thus, the equilibrium between fulfilling educational goals and meeting the requirements of students' preferences is well established, hence improving the quality of the learning experience.

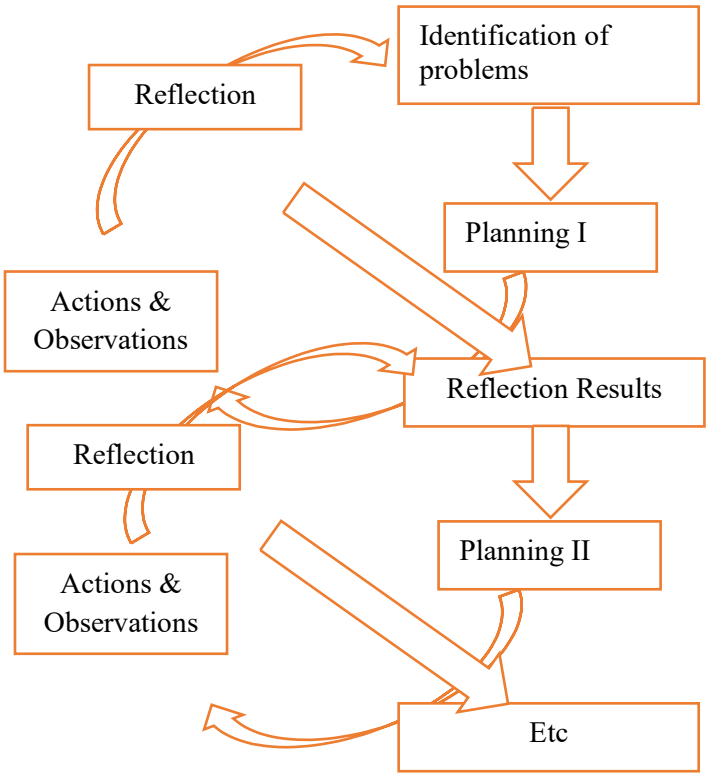

Figure 1. Classroom Action Research with the Kemmis & McTaggart Model

2. METHOD

This research is class action research, which is a form of scientific activity in the form of actions taken by the teacher who acts as a researcher in class to fix problems that exist in the class.[16]. This Classroom Action Research uses a model developed by Kemmis & McTaggart (2014), in general, the process carried out in this Classroom Action Research activity is shown in Figure 1.

There are four stages carried out in this Classroom Action Research activity. These stages include (1) planning, (2) action, (3) observation, and (4) reflection. In the Kemmis and McTaggart models, actions and observations are carried out simultaneously; this is due to the fact that the two are related to each other, and observations should be carried out during the process of giving actions.

This research was conducted at SDN 184/V Parit Ponco, Jambi Province. Students with a small number provide opportunities for teachers to maximize the process and learning outcomes because it is easy to control student activity. This research was conducted on grade II elementary school students. The number of respondents in this study was 7 students.

This study aims to improve the learning process. In this case, the improvement is focused on improving learning outcomes and student learning activities. Student learning outcomes are obtained by giving test questions in the form of 10 multiple-choice questions that are appropriate based on expert judgment and empirical testing. For the observed learning activities using aspects according to those studied by Aliwanto (2017) [18] but not using the drawing aspect.

3. RESULTS AND DISCUSSION

This study will discuss changes in the ability or learning outcomes of mathematics on the topic of addition and subtraction and student learning activities during the learning implementation process using concrete media.

3.1. Cognitive learning outcomes of addition and subtraction

In general, students' mathematics learning outcomes, in addition to subtraction material, experienced an increase in each cycle. Data on changes in student learning outcomes are shown in Figure 2 below. The data in Figure 2 shows that the average score of student learning outcomes always increases from each cycle. In the pre-cycle, the average score of student learning outcomes was 32.86, and there was an increase of 12.85, so the average score of student learning outcomes was 45.71 in cycle I. This increase also occurred from cycle I to cycle II, namely 30.00. The average score of student learning outcomes was 45.71, which increased to 75.71 in cycle II. In general, students have experienced an increase for each cycle. For student 2,

the scores obtained were constant, namely 70 in cycle I and cycle II. Likewise, for student 4, the score obtained remained the same, namely 30 in pre-cycle and cycle I, but increased drastically in cycle II.

The increase in student learning outcomes scores shown in Table 2 indicates that efforts to improve mathematics learning problems on the topic of addition and subtraction have shown positive results. This happens because, during learning, students are invited to play with concrete media. With this concrete media, students become more active and interested in learning. This is important to shape the character of students because the true character of students must be built from an early age [19], especially building active character in learning, especially for instilling. In addition, the use of real/concrete objects is a good way of learning [20], especially in visualizing abstract things. Concrete media also has many advantages, such as being easily manipulated according to needs [21]. This makes learning more quality.

Previous researchers have carried out research related to the effectiveness of using concrete media in learning. Concrete media in learning mathematics has succeeded in increasing student learning outcomes in the material for integer addition operations [22]. In science learning, the implementation of concrete media also succeeded in increasing learning outcomes [23]. In the implementation of the 2013 Curriculum, the use of concrete media also succeeded in increasing learning outcomes on the theme of entertainment [24]. Even in chemistry subjects, the use of concrete media in the form of card media has also been researched and is effective in learning activities [25].

The use of learning media is important to improve student learning outcomes. Students will better understand and use their knowledge when they remember and understand deeply. Because students who fail to answer questions are not always caused by not understanding the concepts they should use in answering these questions but because students fail to recall the knowledge they already have [26]–[28]. In addition, the use of media is also important to ensure that students do not build their own conceptions, which are often wrong [29], [30] and hard to change [31].

The use of media tools in mathematics, such as learning, aids in bridging what is considered abstract, such as the concepts of addition and subtraction. From this point, students are able to understand the procedures being introduced rather than the harsh route of mere memorization; this is made possible by the use of learning media in the forms of visuals and interactive technologies, among many others. To elaborate this claim further, one can easily visualize the process of joining or taking away objects in order to see the true meaning behind these two concepts.

Additionally, these media tools address other learning styles, whether it be visual or auditory, thereby providing equal opportunities for learning among students. This also encourages movement for the students as they engage not only with the learning materials but with each other, enabling them to capture the true essence of the content in terms of the processes involved in problem-solving. Cognitively speaking, the media tools create an easier way for students to interpret ideas as they provide vivid experiences. The media aids thereby not only enhance the efficiency of gaining knowledge via the engaging and realistic method but also help students get a grasp of the subject matter fully.

3.2. Students' Learning Activities in the Use of Interactive Media

In addition to increasing learning outcomes, the application of concrete media can also increase student learning activities. Data on student learning activities in each cycle is shown in Table 1. The data in Table 1 shows an increase in student learning activities during the learning process using concrete media. The percentage of active students in all aspects has increased. The average percentage of students in pre-cycle was 39.16%, then increased to 75.23% in cycle I and to 87.39% in cycle II. The aspects of visual activity and listening activity even experienced a significant increase from pre-cycle to cycle I.

The increase in student learning activities occurred after the implementation of concrete media in explaining addition and subtraction material. This happens because students are invited to learn while playing so as to increase student interest in learning. Teachers will be better prepared if they teach using interesting learning media. In this study, real media in the form of identical pictures with bright colors, pieces of sticks, and pictures of plane shapes aim to make it easier for students to imagine the physical meaning of addition and subtraction in mathematics. With the media, students will also be better prepared to learn. The condition of students who are ready to receive lessons when in class will be able to trigger a positive response from students to the stimulation given by the teacher [18]. As is the case with the practicum method, which requires students to be directly involved in learning [32], learning that is done when students learn by using concrete media also involves students directly in the learning process, thereby increasing student learning activities.

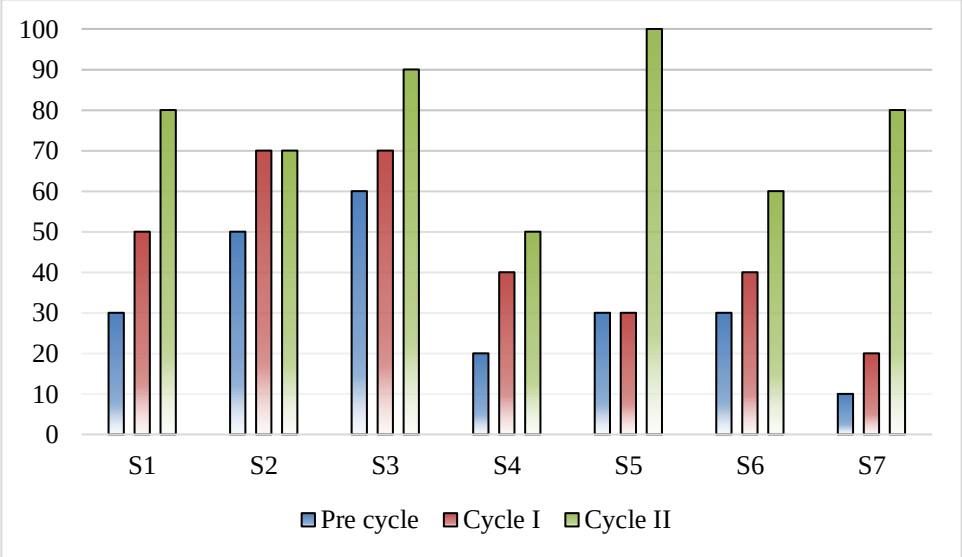

Figure 2. Each Student's Score in Each Cycle

Table 1. Percentage of Students who are Active in Learning

No	Criteria	% Student		
		Pre-cycle	Cycle I	Cycle II
1	Vision activity	56.78	100	100
2	Oral activity	16.38	58.27	86.63
3	Listening activity	42.34	100	100
4	Writing activity	31.56	45.74	74.21
5	mental activity	43.63	73,56	76.29
6	emotional activity	44.26	72.16	87.22
	Average	39.16	75.23	87.39

The integration of concrete learning media in the materials of addition and subtraction operations in the low primary grade level has strong educational justification of increasing students' learning activities. With the help of concrete materials such as buttons, blocks, or other real objects, students are able to grasp the concepts of addition and subtraction by having relevant practical experiences. As a result of seeing, touching, and manipulating these objects, students tend to have more imagery of their lives in this abstract mathematical world, and they are better apprehenders. Moreover, Concrete media generates an interesting atmosphere for the lesson, which makes the students participate actively during the lesson. These manipulative activities also address to different types of learners, and for those children who are kinesthetic or visual learners in particular.

Integrating concrete media into the learning process enables students to work collectively within a group. This fosters students' self-confidence as they can attempt to work independently to find the solutions to the problems posed. From a psychological standpoint, teaching with the help of concrete media assists learners in associating new information with their prior knowledge, thus making the content being taught more retrievable. Furthermore, it fosters greater interest among students and encourages them to perform mathematical assignments since they regard the task as worthwhile and within reach. In other words, concrete media not only enhances the learners' activities but also helps them develop a strong conceptual understanding of the basic operations of addition and subtraction. The approach taken is consistent with pedagogy that claims that learning that is active, situated, and relevant is more comprehensive and durable.

4. CONCLUSION

Learning by using concrete media can improve students' mathematics learning outcomes in addition and subtraction material. In addition, student learning activities have also increased. Student learning outcomes increased from 32.86 in pre-cycle to 45.71 in cycle I and to 75.71 in cycle II. Student learning activities increased with an average percentage of students in pre-cycle of 39.16% then increased to 75.23% in cycle I and to 87.39% in cycle II.

The application of learning using this media must continue to be developed. The teacher should not only teach with the lecture method without learning media. Students will feel interested when the teacher uses learning media that makes it easier for students to understand concepts well.

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