



THE DEVELOPMENT OF NUMBER TEACHING AIDS TO MINIMIZE MISCONCEPTIONS OF ELEMENTARY SCHOOL STUDENTS IN THE KUPANG CITY

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Abstracts: The problem often faced by elementary school teachers, especially those of the lower-class, is the creation of pleasant mathematical learning strategies capable of minimizing the numerous misconceptions experienced by students. One of the alternative solutions adopted is the application of the right learning media; a mathematics teaching aid for elementary school students. This study aims at developing a number teaching aid for elementary school students using natural materials commonly found a school's surrounding environment. Using these materials will enable both teachers and students create inexpensive teaching aids, thereby, enhancing students' mathematical ability and their interest for their surrounding environment with the expectation that they become a generation capable of preserving and protecting nature and the earth in the future. The development research (DR), a research method that focuses on product design, product validation, small-scale usage tests and final product revisions and the observation methods were used to collect data. The DR model used was developed by Akker. The research was divided into the following stages; (1) design of number teaching aids and their operations, (2) product validation tests by mathematicians and learning media experts, (3) product revisions as a result of expert testing, (4) product use tests in limited class to see product practicality (5) product revisions as a result of limited use tests. In the final stage of this research, a cheap, and easy to use teaching aid package for elementary school students was produced. Results obtained from an interview conducted on teachers and students proved that this teaching aid reduced the numerous mathematical misconceptions experienced by students and increased the growth of students' positive attitudes towards their surrounding environment.

Keywords: *teaching aid, concepts of number, misconception*

INTRODUCTION

The mathematical concept *spiral in nature*, with each concept relating to the next. As a result of this, an error in understanding the previous concept, will certainly affect the next. According to a 2002 study carried out by Ekowati on class VII students of an elementary school, the application of a constructivism approach can be used to minimize the misconception of the mathematical concepts made by students which resulted to an increase in students learning outcome.

To elementary school students, the word "mathematics" is analogous to the sounds of thunder roaring the sky. This is an allegory used to imply the decline in mathematical concepts with regards to our daily life. (Ekowati, 2008) study showed that the appropriate mathematical learning approach for elementary school students, especially those at the lower grade level, was a realistic mathematical approach that began with a contextual example. This step is ideal to the level of concrete thinking of children between the ages of 7-12 years or at the elementary school level (Jerome Bruner's learning theory). The learning concept of integer operations given using the number beads made from manila cardboard increased students' understanding of integer addition and subtraction.

The 2013 curriculum testing in numerous Indonesian schools, showed a high rate of problematic learning process. This was owing to teachers divided attention in determining if developing an appropriate learning model was more appropriate to conducting process assessments. This confusion became the foundation of a research carried out by Ekowati in 2015 which focused on developing a mathematical learning device that utilizes the environment as a learning medium. The study's outcome is the development of a student book, teacher handbook, Lesson Plan, learning media for first semester grade 1 elementary school students. The results indicated an increase in ability to understand mathematical concepts.

A further research was conducted in 2016 in which a mathematical learning tool was developed for first grade students in the second semester of elementary schools. This tool along with the teacher's guidebook and student books for a year was used to complete the learning process. The purpose of this study is to increase student's knowledge on their surrounding environment at an early age. The materials used in developing the learning media were found in the school's surrounding environment, thereby, making it easier for teachers to create.

Based on the five results obtained from the previous studies, the following conclusions was drawn: teaching mathematics to first grade elementary school students should be contextual, realistic, fun, close to nature (outdoor learning) and optimized using simple inexpensive mathematics teaching aids so every student will find the subject interesting and not scary. For this reason, researchers want to conduct a research focused on the utilization of materials found in the natural environment in developing mathematical teaching aids. This tool will enhance elementary students' ability to understand mathematical concepts, hence, reducing the reoccurrence of mathematical misconceptions. This research is an accumulation of previous research results which incorporated the natural environment tools into mathematical concepts, making it possible for students to develop into humans with high mathematical logic and with love for their natural environment. It is expected that in future a new intelligent generation capable of preserving its natural environment will emerge.

MATERIALS AND METHODS

Good teaching aids must be able to meet the following criteria: (1) Explain the concept appropriately, (2) Attractive, (3) Durable, (4) Multi-function (can be used to explain various concepts), (5) The size is appropriate with student size, (6) Cheap and easy to make, and (7) Easy to use.

Teaching aids are needed in mathematics learning because; (1) abstract mathematical objects need demonstration, (2) the nature of mathematical material is not easily understood, (3) learning mathematics can be boring –with lots of difficulties, (4) students' cognitive abilities are still concrete, (5) student learning motivation is not high, making mathematics applications incomprehensible, and tiresome-. Mathematical teaching aids have a very important role in aiding students understand various mathematical concepts. In certain cases, it will determine the success of the learning process itself, because generally, students are able to understand abstract concepts through visualization.

The initial concept possessed by students is sometimes incompatible with those of scientists. The variation of these concepts is known as misconception (Sutrisno dkk, 2007). Various misconceptions that occur in students learning process will result to mistakes in solving questions, thereby, affecting its outcome. Hence, it is advisable that these misconceptions in students do not last long. However, most teachers also find it difficult to assist students in this category, especially those that use these misconceptions as a means to solve certain problems (Suparno, 2013).

Students tend to think about what they do in various ways, such as using formulas, interrelated concepts, and pleasure; which are part of their strategies

used in understanding mathematics. One major problem why students find it difficult in learning and understanding mathematics is the inadequate experiences gained from previous teachings, or their inability to remember past teachings. This includes understanding or thinking not based on the right information. The validity of information refers to the right source and accompanied by authentic evidence. Changing students' framework is the key to achieving goals to improve mathematical misconceptions.

Generally, the context of everyday life really needs to be presented as a source of mathematical mental formation. In teaching fractions, a teacher could use a cake to illustrate. Dividing the cake into several parts would be a perfect way to simplify fraction. Students will understand how a whole cake is cut and shared among two people, four people, or more. When students assume that one of the images presented in figure 2 shows part of $\frac{1}{4}$, we can re-express how to divide the cake and ask whether the results of the second slice of the cake are the same or not.

Research on teacher responses to student misconceptions was carried out by Chick and Baker among nine Australian teachers. The participants were teachers of 5 and 6 grades (students aged 10-12 years) with 2-22 years teaching experience. This research on pedagogic abilities was carried out using by completing questionnaires and interviews regarding the answers written in the questionnaire. The questionnaire contained several questions relating to the mathematics learning situation and the teacher's perspective. The participants filled the questionnaire without time limits and sources of answers. The researcher interviewed participants to clarify ambiguous answers or writing errors. Participants were able to answer four items from the entire questionnaire. Four questions are designed to understand how teachers respond to student misconceptions, with focus on algorithms, fraction distribution, fraction addition, and the relationship between area and circumference.

The research type used in this paper is development research. It comprises of various three stages; (1) survey method to take preliminary researched data, (2) development methods to develop mathematical teaching aids based on their surrounding environment, and (3) observation methods used to observe reduced student misconceptions towards mathematical concepts and to observe students' attitudes in caring for their natural environment.

The following is a fish diagram that explains the method used in this applied product research

FINDINGS AND DISCUSSION

Needs analysis is obtained from previous research results developed from thematic mathematics teaching materials. Furthermore, a number of teaching

aids were designed such as block dienes, number beads, block counts, HCF & LCM boards and guessing cards. When the design of the teaching aids is ready and incorporated in one package, it is validated by mathematicians and environmental experts in Kupang City.

Mathematical expert of Dr. Wara Sabon Dominikus, M.Sc using the validation instrument prepared gave an assessment, beamed that the teaching aids were good (score of 4, data attached). Some of the inputs given include: (1) the size should not be too small, (2) plus the age guess card and the guessing date of the card, (3) the patent is made to be durable and (4) made in large quantities. Suggestions from the mathematical validator were carried out before the trial of small classes and large classes. Furthermore, the assessment of environmental experts; Dr. Andam S. Ardan, S.Si, M.Si, gave a score of 4 for the material used, because it utilizes several environmental wastes such as mineral bottle caps, , grass tree trunks re widely found in Kupang and lots more.

After the tool was validated by experts, a small class trial was carried out in fifth grade of SDK St. Arnoldus Kupang. The outcome of the results is that enough number beads are available in integer learning operations (score of 3, attached data). Trial of diene block teaching aid was conducted and used on first grade students in the same elementary school which gave very practical results (score of 4, data attached). All teaching aids produced were not revised because there was no input from the teacher during the trial use. As a final step, a large scale trial was conducted in two schools, namely Angkasa Kupang Elementary School and SDK St. Arnoldus Kupang. The results showed that students were active and enthusiastic to learn because they learn, feel, and see what the teacher is using to teach them. The following is a photo of the number concept; a teaching aid which happens to be the last prototype:



To have an idea of the reduction in students' misconceptions on numbers and operations, interviews were conducted on several students about the meaning of some concepts and their knowledge of the natural

environment at school. The results of an interview with a first grade student showed he currently understood the meaning of number 2 in numbers 23 and 12 because he was taught using the block dienes props. Furthermore, the results of interviews with third grade students on the environment showed that they no longer dump refuse or garbage indiscriminately in the school gutter as it could lead to flood when it rains. The recapitulation of the results of interviews with 50 students about some misconceptions and about caring for the environment is presented in the following table:

Table 1. Recapitulation of Interview Data on Misconception

No	Indicator	Procentage
1	Understanding the concept of place value	80% (40 student)
2	Understanding the concept of integer addition	70% (35 student)
3	Understanding the concept of a number factor	70% (35 student)
4	Understanding the concept of multiples of a number	70% (35 student)
5	Understanding of mathematical meanings in everyday life	84% (42 student)

Source: primary data

Table 2. Recapitulation of Interview Data on Environmental Care Attitudes

No	Indicator	Procentage
1	Understanding of cleanliness	100% (50 student)
2	Understanding of the importance of trees in the school yard	90% (45 student)
3	Happy learning outside the classroom (outdoor learning)	100% (50 student)
4	Understanding of the importance of caring for plants at home	80% (40 student)
5	Understanding of the production of oxygen by green plants	40% (20 student)

Source: primary data

After going through the stages of product design, validation, revision, and testing using small and large classes, the final step of this development research procedure is to increase the product that will be distributed to 4 elementary schools in cluster X, i.e. Angkasa Elementary School, SDK (Christian Elementary School) St. Arnold, SDI (Islamic Elementary School) Naimata and SDI (Islamic Elementary School) Nasipanaf. Each school gets a number props package consisting of teaching aids (1) block dienes, (2) number beads, (3) counting blocks, (4) HCF & LCM boards and (5) number guess cards.

CONCLUSION AND SUGGETIONS

Based on the results from the implementation of the developed teaching aides, it can be concluded that the use of mathematical teaching aids, especially props of concept numbers is very useful for students and teachers. Learning becomes fun and less boring for students who now actively participate in the process. Some suggestions in this study include: (1) learning media in the form of mathematical teaching aids are very important to help students develop early love for mathematics, thereby, eliminating any early misconceptions, (2) teaching aids can also be produced with local materials around us, (3) outdoor learning should be considered to promote environmental awareness from an early age.

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