The Use of Mathematics Teaching Aids to Train Metacognition Ability of Elementary School Students

Mustamin Anggo* & La Arapu
Mathematics Education, Universitas Halu Oleo, Kendari, 93231, Indonesia,
*mustaminanggo@gmail.com

Abstract: The use of mathematics teaching aids in elementary school is useful not only for the acquisition of knowledge, but also for the formation of student awareness of his ability and the arrangement of his thinking in solving problems. This relates to the students' awareness of their ability to develop various possible ways in solving problems. The process of realizing and organizing of one own thinking is known as metacognition. The involvement of metacognition in learning provides great benefits to students in particular to strong mastery of the subject matter. The methods used in the study are: implementation of learning using mathematical teaching aids by applying metacognitive strategies, observations, tests, and interviews. The results showed that: (1) the utilization of teaching aids in learning mathematics provides excellent opportunities for planting understanding of the concept to the students based on their awareness about why and how a concept built and then can use the awareness to solve problems (known as metacognition), (2) train metacognition skills for elementary school students will be very good when done in learning mathematics by using teaching aids. Based on these reasons, it is important for teachers to train metacognition ability especially in solving mathematics problems for elementary school students.

1. Introduction
Through mathematics learning, students have to experiencing the improvement of cognitive, affective, and psychomotor abilities simultaneously. The ability can be achieved if learning is done base on the standard of learning quality, where students actively involved in process as the main subject to reach the learning needs. Silberman [1] suggests that when learning activities is passive, students follow the lesson without curiosity, without question, and without interest to the results. While learning is active, students will pursue something. He wants answers the question, needs information to solve a problem, or find the way to do the task.

There are many options can be taken to get students actively involved in learning, one of them is the use of mathematics teaching aids. Through learning mathematics using teaching aids, students will be able to understand abstract mathematical concepts through exploration of concrete objects. This understanding is important, becouse of elementary students based on Piaget's cognitive development theory, are still in a concrete operational [2]. The main feature at this stage is understanding of abstract concept can only be constructed if it can be represented by concrete objects or situation.

The rationale confirms that learning mathematics by using teaching aids is useful not only for acquiring knowledge, but also for the formation of student awareness and arrangement of thinking in
solving problems. This is agree with Lester's opinion [3] that the primary goal of teaching problem solving in mathematics is not only to equip students with a set of skills or processes, but rather to enable students to think about what they think. This relates to the student's awareness of his ability to develop various ways might be pursued in solving problems. According to Gartman and Freiberg (Anggo) [3] The process of realizing and regulating students' own thinking, known as metacognition.

The involvement of metacognition activities in learning provides great benefits for students especially in strong mastery of the subject matter. This can happen because the metacognitive processes are bring to optimize one's cognitive activity in an effort to achieve learning goals [4]. Some researchers have shown that: (1) the students who are skilled in knowing and regulating their cognition, shows the ability to think more strategically than who are unaware about how their mental systems work [5]. (2) Students with good metacognition skills, perform problem-solving based on a strong understanding of each step of activities, and can use their ability to solve more complex problems [6].

The use of teaching aids in mathematics learning allows students to understand concepts more easily and solve problems well. This can be achieved because the learning process is done by involving students both in physically and mentally, so the learning happens more meaningful. Through the meaningfulness of learning, students are trained to realize their thinking during learning activities, and use that awareness to organize the thinking process in particular in problem solving. The awareness and regulation of thinking is known as metacognition.

According to the author's experience in education and professional training of teachers from 2010 until now, there are still many elementary school teachers in particular in Southeast Sulawesi are less familiar with the use of teaching aids in learning mathematics. This situation is quite apprehensive, especially when considering the importance of mathematics in elementary school as the basis for the formation of student thinking, which is important for learning in the next stage. One of the important things in presenting mathematics to elementary students is to use concrete objects to bridging between abstract mathematical concepts and the thinking stage of students which are still in the concrete operational.

1.1. Learning Mathematics

Learning is an effort to make students learn. The intended effort includes the activities of teachers and students in a process so that students can obtain the learning outcomes which have been planned. In its implementation, the teacher becomes a person who did control the learning, with the main role of providing assistance, facilitating, creating conditions that enable students to attain qualified knowledge, skills, and attitudes. Learning as a system may not be separated from the subjects who are taught (students), teaching materials (mathematics), subject who are teach (teachers), and media/teaching aids. Students as subjects are people who have the perception, attention, understanding, reasoning, motivation, culture, and ability to adapt to the environment.

In learning of mathematics in elementary school, teachers are required to carry out various activities that allow students to be encouraged to engage their minds with abstract mathematical material. This situation would need a variety of equipment or media that can help the abstract concept of mathematics can be understood well. The abstract concepts needs to be realized because according to Piaget's grouping of thoughts, elementary shool students in 6-12 years old are still in the concrete operational phase of thought [2].

Based on that understanding, the learning of mathematics in elementary school may only be able to run well if implemented by paying attention to the effort to bridge the gap between the abstract concept of mathematics and the concrete thinking stage of the students. The choice can be taken is the teachers need to create learning which make the abstract concepts can be presented concretely so that students can easily understand. This is the importance point of the use of teaching aids in learning mathematics.
1.2. Teaching Aids As a Learning Media

The use of teaching aids is familiar in the learning process in Indonesia. Various types of teaching aids have been applied in learning, ranging from simple to complex. All is done with the intention that students can absorb the lessons better.

The learning process is essentially as the activity related to information processing [7]. In the learning process, information intermediaries are known as learning media. There are quite a lot of definitions about the media, including a variety of components that exist in the environment that can stimulate students to learn. Miarso [8] argues that media is anything can be used to channel messages that can stimulate the mind, attention, feelings, and willingness of students to learn. Based on these views, media is everything that can be used to channel the message and can stimulate thoughts, feelings, attention, and willingness to encourage the learning process for students.

In learning mathematics, one form of media that is quite widely known is the teaching aids. The teaching aids is a learning media that contains or brings out the characteristics of the concept [9]. The main function of teaching aids in learning mathematics is to derive the abstract nature of mathematical concepts by using concrete objects so that students can understand the concept more easily.

The situation can occur because in the learning using teaching aids, students are involved directly in it through observation, try some thing, practice, and experience own learning events. According to Ratumanan [10] in learning through direct experience, students not only observe directly, but they also have to live it, be directly involved in deeds, and be responsible for the outcome.

Based on the description, it is clear that the use of teaching aids in learning will contribute greatly to the improvement of students' ability to master mathematical concepts. What needs to be done now is to prepare teachers in using teaching aids accompanied by the preparation of learning tools and appropriate learning strategies to support the implementation of qualified learning.

1.3. The Teacher Role in Training Student's Metakognition

Metacognition has two dimensions; (1) metacognitive knowledge and (2) metacognitive regulation. According to Brown (Gama) [11] metacognitive knowledge influenced by age, while metacognitive regulation is relatively free from the influence of age. This means that the students along the progress of learning will shows the development of skills in metacognitive knowledge although he never been in education that is specially prepared to train metacognitive knowledge.

On the other hand, the metacognitive regulation is relatively free from the influence of age but more affected by the situation and task. This means that a person could not obtain or improve his metacognitive regulation skills without going through a process of preparing for it. This is the reason that the teachers have to be able to prepare lessons that can encourage students to manage their cognition by pay attention to the situations and tasks. In addition, the ability of one's metacognitive regulation is unstable, so this ability needs to be raised continuously.

The importance of training students' metacognition skills has also been the concern of cognitive psychologists, namely by suggesting that metacognitive strategies need to be given to students through the mathematics learning process [12]. For that reason, teachers are expected to train students' metacognition abilities on their mathematics learning, including in problem solving.

In relation to the involvement of metacognition activities (planning, monitoring and evaluation of self-learning) in learning to achieve goals, Griffin et al. [4] suggested that there are two main factors determining the alignment between action and objectives in learning: (1) the application of metacognitive knowledge has been associated with a particular task, strategy or ability to select appropriate cognitive actions to improve the quality of learning, (2) metacognitive reactions in obtaining subjective internal experience as a result of cognitive actions performed by students according to their level of learning progress.

Based on the facts mentioned above, it is clear that the application of metacognition in learning mathematics allows students to master the subject matter well. Mastery of the subject matter is an important factor that shapes the ability in mathematics. Conversely low metacognition ability will result in less optimal students' mathematical ability.
2. Research Methods

The learning development model used in this research is the 4-D model proposed by Thiagarajan, Semmel and Semmel [13]. The model consists of four stages that are: (a) define, (b) design, (c) develop, and (d) disseminate. The 4-D model is chosen because it is more detailed and systematic so that the learning development process can be done more easily. The development of learning design using mathematics teaching aids will be directed to learning that can improve students' metacognition abilities. In this paper, the results of disseminate activity are not presented. The stages of development are described as follows:

a. Define; the aims of this stage is to define the learning needs by analyzing the objectives and the material. The activities in this stage are initial investigation, student analysis, material analysis, task analysis, and specification of learning objectives.

b. Design; the purpose of this stage is to develop the learning design by using mathematics teaching aids to train students' metacognition abilities.

c. Develop; the aims of this stage is to produce a design of learning using the mathematics teaching aids that can be used in learning. The activities at this stage are: (a) validation of learning design; is intended to obtain data of the validity of strategy, the validity of mathematics teaching aids, and the validity of learning tools. Validation is also performed on supporting instruments used in the study, including: observation sheets, student response questionnaires, interview guides, and evaluation of learning outcomes, (b) trial implementation; includes testing of: strategies, mathematics teaching aids, and learning tools that have been validated. Trial implementation conducted in two parts, namely trial implementation 1, is implemented in a limited and more emphasized way to see the suitability between the instructional design formulas and the actual learning situation. Trial implementation 2, implemented on a wider scale with respect to the diversity of learning situations. The goal is to obtain more complete information about the suitability of the design of learning with varied learning situations.

d. Disseminate; is the end of the development activity, which includes the socialization and implementation on a wider scale.

3. Discussion

Development procedures are carried out since the beginning of making teaching aids. The teaching aids development are based on the study needs of elementary school students by considering the 2013 curriculum, students 'learning readiness, and suitability of teaching aids with the students' daily life. This study was conducted in order to have teaching aids produced can bring students actively involved in learning which are in activities, and thoughts.

After finished the production of teaching aids, then test were implement through application of teaching aids in presenting the concept. Implementers of learning in this case are the students of prospective teachers through application in a simulation of learning. The results of the research then made in recommendations forms, include: (1) physical improvement of teaching aids, (2) improvement of learning scenarios, and (3) improvement of teachers' skills in applying learning using teaching aids.

Physical repair of teaching aids is done when there is incompatibility of the tools flexibility when supporting the explanation of a concept. For example, when presenting a negative integer operation, it is difficult to select the corresponding number of pieces, so it needs the use of contrasting colors.

The second improvement also done is the improvement of the learning scenario. This type of improvement is the most common, especially in relation to the sequence of learning activities using teaching aids in the early stages of conceptualization and gradually eliminated, so that students can further apply the concept without the presence of teaching aids anymore. Some scenarios implemented only make teaching aids as part of the concept demonstration. This denies the fundamental function of teaching aids as the completeness imparts the concept to the students. Based on the results of this limited experiment, a sequence of learning activities steps is made by placing the use of teaching aids at the beginning of the learning activities.
The third improvement is the teacher's skill in applying learning using teaching aids. This is related to the teacher's understanding of the concepts taught, and the ability to present them in the appropriate learning steps. In some teaching aids used, found the difficulty of teachers in applying it. Some of these difficulties relate to teachers' inability to translate conceptual cultivation into learning steps using teaching aids. The thing to be done is to train teachers in preparation to implement learning using teaching aids.

The results of the improvement that allow the implementation of learning in sequence of activities starting from the use of teaching aids to understand the concept, using teaching aids to try some application of the concept, and finally complete the exercises without using teaching aids. This stage allows for a more robust cultivation of the concept and encourages students to solve problems by using existing understanding.

This kind of understanding is at the core of the learning process using teaching aids where students are trained to realize why and how a concept is built and can manage that awareness when solving problems. When students can build a good understanding of concepts, the awareness and regulation of thinking will be very strong, so that when faced with a problem can determine the solution well even though the context of the problem has changed.

4. Conclusion
Based on the above discussion, it can be concluded that:

a. Utilization of teaching mathematics aids in learning mathematics provides excellent opportunities for planting understanding of the concept to the students based on their awareness about why and how a concept built and then can use the awareness to solve problems. This is known as metacognition.

b. Train metacognition skills for elementary school students will be very good when done in learning mathematics by using teaching aids.

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