ATLANTIS PRESS
Advances in Social Science, Education and Humanities Research (ASSEHR), volume 227
1st International Conference on Advanced Multidisciplinary Research (ICAMR 2018)

Approach to Learning Mathematics with Metacognitive Guidance

Salim
Department of Mathematics Education
Halu Oleo Universit
Kendari, Indonesia
salimpsa@gmail.com

Arvyaty
Department of Mathematics Education
Halu Oleo University
Kendari, Indonesia

Era Maryanti
Department of Mathematics
Halu Oleo University
Kendari, Indonesia

***Abstract*—The process of student's metacognition is a thought consciousness within the students so that it can perform special tasks, and then use that awareness to control what students will do. Metacognitive guidance based on the self-questioning who constructed own students through exercises on a regular basis. The purpose of this study is to describe the metacognitive guidance grade VIII SMP Negeri 12 Kendari. The results of this research show that students who use a metacognitive guidance approach better than the students who use the conventional approach, the existence of the metacognitive guidance approach makes the students interpret a problem so that it is capable of describing a mathematical problem with their own language. Therefore, it is able to solve math problems. In addition, this study uses a metacognitive guidance approach focused on four basic questions that must be mastered students, i.e., comprehending the problem, constructing connections, use of strategies, and the reflecting.**

Keywords—metacognitive guidance, self-questioning, mathematical problem

I. INTRODUCTION

The problem of low-quality educational results needs to be traced to a variety of possible causes related to factors affecting the success of student learning. In the learning of mathematics in Indonesia, the ability of the students in the mastery of mathematics is quite low. TIMSS survey in 2011 put Indonesia on rank 38 of 42 countries. Although the average score down to 386 compared to 397 in 2007, the decrease in score was still below the average for the ASEAN region. The achievement was relatively even worse on PISA survey year 2003 with Indonesia ranked 38 out of 40 countries and only one rank higher from Tunisia [1].

Factors affecting the results of student learning is the learning process [2]. However, the process of learning mathematics Junior Secondary School 12 Kendari City Indonesia has not shown maximum results caused mathematics teacher has yet to determine the right strategy in teaching and lack of interest in student learning. Cause factor of low-interest student learning that is students less accustomed to doing the process of solving connection correctly, i.e., with the stages of the understanding problem-solving, the planning problem-solving, the implementing problem-solving and the check problem-solving [3].

Teachers should select and assign the right learning approaches in order to assist students who lacked curiosity and student inquiries to learn. Pattern learning with students memorizing formulas without applying them in real life will lead to passive students in learning mathematics that have an impact on the results of learning math students do not maximally [4]. With respect to the problem of learning mathematics students need new an approach of learning to train students skills in solving mathematics. One approach to learning that is quite relevant to use in learning mathematics is a metacognitive guidance approach.

A metacognitive guidance approach is an approach to learning to improve the skills of metacognition. These skills are quite complex, so it takes long enough time to learn by students so that necessary efforts gradually to have skills in Metacognition [5]. Therefore, these skills can be started by a teacher with students familiarize to use metacognitive guidance approach in learning to be able to solve the problems of mathematics.

The application of metacognitive guidance approach in learning mathematics to enable students in constructing knowledge, so that students have an awareness of what is already known and unknown as well as how they choose the right strategy to solve a problem. If the student has a good ability in solving mathematics problems so students can understand a problem with thoughts and assumptions of their own and ultimately improve student learning outcomes. The existence of a metacognitive guidance approach is one of the factors at the same time learning innovations grant of serious attention to student learning at school [6].

The purpose of this research is to analyze the implementation of metacognitive approach guidance in mathematical learning in Junior Secondary School 12 Kendari City Indonesia.

II. LITERATURE REVIEW

Metacognition was first introduced by Flavell in 1976 based on the concept of meta-memory [7]. Flavell defined metacognition as awareness of how he learned, the ability to assess the difficulty of a problem, the ability to observe her level of understanding, the ability to use a variety of information to achieve goals, and the ability to assess their own learning progress [8]. Metacognition as the ability to identify what is what you know and what you don't know, associate information or new knowledge with the knowledge already acquired earlier, planning the completion strategies, as well as to monitor and evaluate the process of thinking is done [9]. it is important to give learners the time and opportunity to talk about thinking processes, to make their own thought processes more explicit, to reflect on their strategies and thus gain more self-control. Acquiring and

using metacognitive skills has emerged as a powerful idea for promoting a thinking skills curriculum [10].

Metacognitive guidance is a learning support system which is used to train the skills of metacognition are also an important part for cognition in humans [11]. Learning with metacognitive guidance approach used to increase individual awareness and control over learning. This approach was used to enhance students ' learning skills through instruction a systematic study of the instruction [12]. During the learning process by using metacognitive guidance approach, students are encouraged to observe and explain the performance done on their own through the reflection questions asked to improve skills metacognition [13].

Metacognitive approach guidance is based on an Improve approach was also initiated by Mavrech and Kramarski [14]. In the method of Improve, there are three important components namely: metacognitive questioning, cooperative learning, dan systematic provision of feed back-corrective-enrichment. Based on the method of Improve then metacognitive guidance approach contains four levels of questions, namely:

- The comprehension questions, which are designed to encourage students in imagine or think of tasks or questions before solved.
- The connection questions, to encourage students to focus on the similarities or difference of duties/job they do now with the tasks/jobs that already they used to do before.
- The strategic questions designed, to prompt students to consider the proper strategies in completing a given task or problem and what can be given.
- The reflection questions designed, to encourage the students to reflect on their intuition and understanding during the process was underway.

III. Research Method

This research is a research experiment with designs using Posttest-Only Control Group Design in which there are two study groups are chosen at random [15]. One group as the group experiment which was given preferential treatment and one other group as a group the control group used a comparison group of experiments.

This research was carried out at the grade 8 students of Junior Secondary School 12 Kendari City, Indonesia year lessons 2017/2018. The subject of class trials conducted on grade 8 by the number of classes required as many as two classes with details of one class of experiments for learning Mathematics using metacognitive guidance approach and control for class 1 conventional learning. Free trial classes are also selected by adjusting the alignment of the subject matter, parallels the rank of class, and the spread of students in every class.

Data collection instruments in this study are (1) rubric metacognitive guidance skill drawn up based on aspects of metacognitive guidance that includes a comprehension question, connection question, strategic question, and reflection question; (2) the now student response student response used to against learning math with metacognitive guidance approach.

The analysis of the test of independent samples t-test (party right) use metacognitive guidance approach to know better than the conventional learning, and student response data were analyzed using student response number percentage defined the frequency of students who provide comments on each component divided by the number of students multiplied by 100%. Student response is considered positive if the percentage earned more than 75%.

IV. Result and Discussion

An analysis of the effectiveness of learning math with metacognitive guidance approach in terms of the skills of students in solving math problems based on the stages of metacognitive guidance. Treatment of learning in this study conducted on grade 8 students of Junior Secondary School 12 Kendari City, Indonesia which consists of a group of experimental learning approach to applying metacognitive guidance and control group by applying conventional learning. The results of the comparison of the two study groups can be seen in Table 1.

TABLE I. A Comparison of the Percentage of Metacognitive Guidance Skills

Study Group	Comprehension Question	Connection Question	Strategic Question	Reflection Question
Experiment	85.85%	29.76%	37.93%	33.78%
Control	30.49%	26.83%	24.88%	20.39%

The results of the analysis data contained in Table 1 show that students in the class of experiments with applying to learn with metacognitive guidance approach have a higher percentage than the control class by applying the learning conventional. Students who are taught with the metacognitive guidance approach will easily identify the problems of mathematics with solution appropriately, it is easy to determine the completion strategy matter, and feel confident against calculation solutions answers from mathematical problems.

The effectiveness of learning mathematics can also be reviewed from the difference between both metacognitive skills study groups. To find out the differences between the two study groups using independent sample t-test (party right). Recap of the calculation to the difference of ability in both study groups can be seen in the following Table 2.

TABLE II. Test Results-T Between the Two Study Groups

Study Group	***t***	***df***	***Sig (2-tailed)***
Experiment	8.082	50	0.000
Control			

Based on the results of the analysis in Table 2, it can be said that there is a significant difference between learning with metacognitive guidance approach and conventional learning. The value of sig on t-test was still two directions so that the value of the sig (2-tailed) should be divided 2 to get a better learning group. The value of the sig (one-tailed) 0.000 smaller than $\alpha = 0.05$ so obtained the conclusion that learning mathematics by using metacognitive guidance approach is better than on conventional learning.

The results of student response towards the learning of mathematical metacognitive guidance approach show

average students have a positive response towards the treatment of learning provided to them. Student response results can be seen in Table 3.

TABLE III. THE RESULTS OF STUDENT RESPONSE

Study Group	Percentage	Average
Interest	81.17%	80.61%
Attention	78.33%	
Convenience	82.33%	

Analysis results in Table 3 show the students have 80.61% of response towards learning by using metacognitive guidance approach. The existence of a metacognitive guidance approach makes it easy for students to understand and resolve the problems of mathematics, students have full attention while following mathematical learning both in the classroom and at home and grow interested students against mathematics.

The results of this study indicate that metacognitive guidance approach needs to be applied in any mathematical learning so that students are getting used to going to the potential of self-awareness towards his thinking ability. Aspects in the stages of metacognitive guidance skills really help students in solving mathematics coherently, so students easily find the solution of the given problem.

On the implementation of the learning mathematics in the classroom, students are always directed to solving math using the stages guidance metacognitive aspects. On the comprehension, a question can be started by asking questions such as deduce with what your language problems of this learning activity, whether known of these problems. Aspects of connection question can be started by asking questions such as does a given problem has to do with the mathematics concepts being studied, how do you figure it out! Explain. The strategic aspect of the question can be started with questions such as strategy/tactics/principles are that can be used to solve these problems, how to solve that problem, write steps to resolve the problem. Aspects of the reflection question can be started with questions such as please check back the truth in your calculations and correction if there is the wrong process, believe you with the truth of your answer, is there another easier way.

Ask questions on metacognitive guidance aspects of teachers can do directly communicated to students before working on the problem as well as the ongoing work on the question. Ask questions can be poured into the student worksheet learning materials as well as in mathematics. Ask sentence question preferably easy to understand the student, familiar with the student's verbal abilities, and fun for students.

Students who are taught with the metacognitive guidance approach will make mathematics problems as a part of his life. The students will feel the problem is a problem that left her so feel have responsibility for finding the solution. Full awareness of the student against his ability would be better if often trained and familiarized through stages metacognitive guidance for getting the maximum student learning.

V. CONCLUSION

The conclusions of this study, namely learning mathematics with metacognitive guidance approach are better than on conventional learning so that it can be said that metacognitive guidance approach quite effectively used in mathematical learning so that it can increase interest in learning and student learning outcomes.

REFERENCES

[1] S. & E. M. Arvyaty, “Design Of Teaching Material Literacy Mathematical Nuanced in Junior High School Students,” in *Journal of Physics: Conference Series. 1028 012140*, 2018.

[2] L. D. H. and M. M. L, “Learner and Instructional Factors Influencing Learning Outcomes within a Blended Learning Environment,” *Educ. Technol. Soc.*, vol. 12, no. 4, pp. 282–293, 2009.

[3] & E. M. Arvyaty, Salim, “Teaching Material Mathematics with a Metacognitive Approach Guidance,” *J. Educ. Learn.*, vol. 12, no. 2, pp. 306–310, 2018.

[4] S. and E. Maryanti, “Pengembengan Perangkat Pembelajaran Matematika Melalui Teori Pembelajaran Sibernetik Berbantuan Software Derive,” *J. Ris. Pendidik. Mat.*, vol. 4, no. 2, pp. 229–238, 2017.

[5] B. K. and Z. Mevarech, “Metacognitive Discourse in Mathematics Classrooms,” *J. Eur. Res. Math. Educ. III (Thematic Gr. 8)*, 2004.

[6] A. A. M. and O. M. F, “Guided-discovery Learning Strategy and Senior School Students Performance in Mathematics in Ejigbo, Nigeria,” *J. Educ. Pract.*, vol. 4, no. 12, pp. 82–89, 2013.

[7] Y. and Zehra, “The Relationship Between Students’ Metacognitive Awareness and Their Solution to Similar Type of Mathematical ProblemS,” *Eurasia J. Math. Sci. Technol. Educ.*, vol. 9, no. 4, pp. 411–415, 2013.

[8] F. J. H, “Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry,” *Am. Psychol. J.*, vol. 34, no. 10, pp. 906–911, 1979.

[9] O. J. and M. M, *Good practice in science teaching*. London: McGraw-Hill International, 2000.

[10] M. C, “From Thinking Skills to thinking classrooms: a review and evaluation of approaches for developing pupils’ thinking,” London, 1999.

[11] and K. Akyüz, Yetik, “Effects of Metacognitive Guidance on Critical Thinking Disposition,” *Pegem J. Educ. Instr. Pegem Egit. ve Ögretim Derg.*, vol. 5, no. 2, pp. 133–148, 2015.

[12] and M. C. Bannert M, Hildebrand M, “Effects of A Metacognitive Support Device in Learning Environments,” *Comput. Human Behav.*, vol. 25, pp. 829–835, 2009.

[13] L. X. and L. J. D, “Supporting Learning of Variable Control in A Computer-Based Biology Environment: Effects of Prompting College Students to Reflect on Their Own Thinking,” *J. Res. Sci. Teaching1*, vol. 36, pp. 837–858, 1999.

[14] K. B. and M. Z, “Cognitive - Metacognitive Training within a Problem Solving Based Logo Environment,” *Br. J. Educ. Psychol.*, vol. 67, pp. 425–445, 1997.

[15] Sugiyono, *Metode Penelitian Kuantitatif Kualitatif dan R & D*. Bandung: Alfabeta, 2010.