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The Implementation of Ttw With *Mic* Approach and *Verbal Feedback Via* Lms Toward the Mathematics Representation Based on *Metacognition*

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Abstract

Learning with a teacher-centered model had not been able to optimize students' higher-order thinking ability. It made the students' metacognition were not maximum especially dealing with the mathematical representation ability. This research aimed to describe the mathematics representation ability based on the metacognitive categories. This research applied a combination method of sequential explanatory with regression test for the quantitative data. The results showed the metacognition influenced mathematics representation ability. Students with reflective use categories could identify and analyze the questions properly. They could also evaluate the answers although some of them did not write the questions into correct mathematics sentences. Students with strategic use categories could identify and analyze the questions properly but they did not evaluate their answers. Students with aware use could identify but they were a lack in analyzing and evaluating. Then, students with the tacit use category were not found. Teachers should direct the students with more development and counseling in a personal manner to overcome the gaps.

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INTRODUCTION

An excellent learning quality becomes effective support in the mathematics learning process. Apipah & Kartono (2017) state that during a learning process, quality should be considered. Junaedi & Asikin (2012) state that mathematics learning should be designed properly to encourage students to have mathematical ability.

The domain of learning quality, according to Danielson (2001), consists of (1) planning and preparing the qualified learning and researching instruments (validated by experts), (2) classroom environment, dealing with the classroom learning promotion with excellent category based on the observers' results, and (3) professional responsibility, dealing with the evaluation process whether the learning has been effective or not.

The classroom teacher habituation about mathematics representation ability had not been maximum. It made the students could not understand the inter-conceptual understanding of mathematics given for them accurately. Minarmi, Napitupulu & Husein (2016) found a correlation between mathematics understanding and representation. Zhe (2012) revealed several mathematics representation forms that could be done as a solution to mathematics tasks. Firstly, it was a visual representation. It dealt with re-presenting the data of information in the form of graphs, diagrams, or tables. Secondly, verbal representation dealt with mathematics task-solution writing stages in words. Thirdly, a symbolic representation that dealt with the equation or mathematic model creations of a certain given task.

Learning with a teacher-centered model had not been able to optimize the students' higher-order thinking ability. One of the cooperative models to facilitate the Higher Order Thinking Ability of the students was the Think-Talk-Write model (TTW).

Yamin and Bansu (2012) stated that the model was originally developed by Hunker and Laughlin. The underlying principle of the model is learning is a social behavior. The stages of TTW consist of thinking, talking, and writing.

According to Wirawan (2016), the strong point of TTW was - it could develop a meaningful solution to understand the learning material. Then, by providing the open-ended questions, students could develop their creative and critical thinking. The third one was the interaction and discussion with the group involved students actively. The fourth one was to habituate students to think and communicate with their peers, teachers, and themselves.

Besides the accurate learning model selection, it is also important to consider the student-centered approach to reach the target. One of the approaches is Mathematics in Context (MIC). Fasha (2017) stated that mathematics learning with MIC could improve the students' creative thinking ability and ability. Learning with MiC habituates students to train their higher-order thinking ability, to transfer their knowledge among disciplines, to collect, analyze, and synthesize information and data from various sources, and to see from various perspectives.

Learning with the Internet or e-learning could create an interesting and joyful learning atmosphere. The use of LMS was done as an addition because the learning process in Islamic Senior High School Zumrotul Wildan was done in a blended-learning manner. The researcher selected an LMS, the Schoology because the application combined both social networks and the LMS (Learning Management System) assisted by the web to interact socially and learn. Manning, Brooks, Crotteau, & Diedrich (2011) found that Schoology could facilitate the learning process because it could improve teacher-student communication and make students responsible for their learning outcomes. Udi (2020) defines Schoology as a social platform for both lecturers and students to share ideas, files, activity agendas, and tasks. It could also create two-direction interaction.

An excellent learning process would provide better effects for the students. By providing feedback, students would find their teachers paid attention to them. Zulfa, Kartono

& Cahyono (2021) found teachers rarely provided feedback after a formative test. They only focused on materials to be finished without thinking about the students' learning inventory. One of the feedback was verbal feedback. Verbal feedback is defined as a communication description provided by teachers to tell the students about their answers' accuracy.

For solving problems, thinking process management is strongly correlated with the students' metacognition. Maulyda, Budiharjo, Efan & Radha (2020) stated that self-reflection or self-metacognitive thinking ability were important for students. This activity influenced the mathematics representation ability since the metacognitive regulator components were in line with the aspects of mathematics representation ability.

The first thing to do was designing the plan based on the visual representation aspect. It was important because students described something in words, verbally, and in a written manner to explain problems and to facilitate their solution. Second, it dealt with monitoring based on the symbolic representation aspect. It was important because students would create an equation or mathematics model from the pre-made representation and do the task by using the equation or the model in their work. Third, an evaluation that was in line with the verbal representation aspect. It was since the students wrote mathematics problem-solving representation by using words.

Salam & Misu (2018) told what Swartz and Perkins found. There were four categories of conscious thinking: reflective use, strategic use, aware use, and tacit use. Each category had indicators on metacognitive regulator components.

The reflective use category refers to a state in which students could promote three regulator components properly. The strategic use category refers to a state in which students could promote the components although one of them is incorrect. The aware use category refers to a state in which students sufficiently could promote the components. The tacit use category refers to a state in which students could not promote the components.

The use of the TTW learning model with the MiC approach and verbal feedback required a complex logical sense of the students. The background knowledge of the students should be used to solve problems in real life and adjusted with mathematics science. This matter is correlated to Piaget's theory about developing the students' assimilations and accommodations so students will experience the equilibrium.

The mathematics problem provision should include real-world experience for the students (the MiC approach). It could develop the ability to construct personal knowledge (the thinking stage), to communicate, and to summarize the results (the writing stage). This matter is correlated to the learning theory of Ausubel, to make the students' learning meaningful.

From the explanation, metacognition has roles to develop mathematics representation ability. This research aimed to describe the mathematics representation ability based on the metacognitive categories.

METHOD

This research was mixed-method research with sequential explanatory design type. The applied research design was quantitative with a quasi-experimental design in the form of the non-equivalent control group design. The design used two experimental groups and control groups with patterns of providing the initial Mathematics Representation Abilitie Test, providing different interventions, and providing final MRST. The researcher took the research subjects from the experimental group with a purposive sampling technique. The subjects were selected with several considerations (Sugiyono, 2016). This research was carried out in Islamic Senior High School Zumrotul Wildan.

The initial data analysis consisted of normality, homogeneity, and initial data average equivalence tests. On the other hand, the final data analysis consisted of normality, homogeneity, and hypothesis tests.

The first hypothesis was about the average accomplishment test assisted with SPPS. It applied the one-sample t-test with a significance level of 5%. If the H0 is accepted, then H1 is denied (Sukestiyarno, 2016).

The second hypothesis was done with the classical accomplishment test. The calculation of the one-party test of the right side was done with the following formula.

$$z = \frac{\frac{x}{n} - \eth_0}{\sqrt{\frac{\eth_0(1-\eth_0)}{n}}}$$

Given,

z: the counted z score

: the hypothesized score

x: the numbers of the accomplished students individually.

n: the numbers of the sample

The third hypothesis was about the average accomplishment test assisted with SPPS. It applied the one-sample t-test with a significance level of 5%. If the H0 is accepted, then H1 is denied (Sukestiyarno, 2016).

The hypothesis about the influence effect was assisted with SPPS. It applied the one-sample t-test with a significance level of 5%. If the H0 is accepted, then H1 is denied (Sukestiyarno, 2013).

The applied research design in the qualitative stage was grounded theory. The qualitative data collecting techniques were questionnaires given at the beginning to group the students based on their metacognitive levels, two-part observation applied during the students' classroom learning, and the students' activities observed by the teacher of twelfth grade at Islamic SHS Zumrotul Wildan. This observation was filled by the teacher during the learning. Then, the last one was an interview after the final MRST and documentation.

The qualitative data analysis consisted of data reduction, presentation, and conclusion. In the data reduction stage, the researchers corrected the students' works by scoring the works, grouping the students' metacognitive levels into four categories, interviewing the subjects, and arranging the interview results with the standard language.

The data conclusion of this research was based on the students' answer sheets and by considering the students' mathematics representation aspect. The aspects were then compared with the metacognitive categories based on the scoring rubrics. Thus, the researcher obtained the combined analysis of mathematics representation ability based on the students' metacognitive categories.

RESULTS AND DISCUSSIONS

The research was carried out from August 2020 until October 2020 with five meetings. The TTW learning concept model with MiC approach and verbal feedback assisted by LMS had three stages. They were the thinking, talking, and writing stages. In the thinking stage, the teacher provided problems based on the MiC approach. It was uploaded first in the LMS so students were asked to read and think about the solution. Then, they should bring it to a discussion forum. The talking stage allowed students to have a group discussion, to share, or to write the solution. Teachers could provide verbal feedback from the obtained results. The writing stage allowed students to communicate their obtained mathematics knowledge after discussion and solve any given problems. The teachers could observe the students' metacognition from the responsibilities of their works.

The use of final MRST consisted of four question items with a 60-minute time allotment. The questions were selected based on eight trial question items and calculated in terms of the validity, reliability, difficulty level, and power of difference.

Based on the normality, homogeneity, and average equivalence of the MRST result tests, it could be concluded that the three classes had the same initial ability. The hypothesis was done by the researcher. It showed that the TTW learning model with MiC approach and verbal feedback assisted by LMS was effective to improve the students' mathematics representation ability.

It could be seen from the first test of the individual accomplishment test. It obtained a tcount = 4.920 and ttable = 1.753. The score was > 1.753, thus t count > ttable. It meant the H0 was denied. Thus, the students' mathematic representation abilitie average intervened by the TTW with MiC approach and verbal feedback assisted by LMS was higher than 56. The obtained average score was 56. It was based on the calculation of the school minimum mastery standard and final accomplishment standard. Secondly, the classical accomplishment obtained a score of 2.272 and 1.64. The hypothesis was denied. Thus, the classical accomplishment was higher than 75%. The third, the average of the difference test, obtained a sig score of (2-tailed) 0.082. The sig (2-tailed) score was higher than 0.05, thus the hypothesis was denied. Thus, the average score of the mathematic representation ability of the students who intervened with the learning model was higher than those who were not intervened by the learning model.

The qualitative research was done to describe the mathematics representation ability based on metacognition. The research sample consisted of 16 students. There were only six students selected as the research subjects. The selection was based on the MRST and the metacognition questionnaire results given for the experimental group. It was done face-to-face.

Based on the linear regression test, the sig score was 0.001 = 0,1% < 5%, meaning it was denied with R square = 0.527 = 52,7%. Thus, there was an influence of metacognition toward the students' mathematic representation ability. It was in line with the study of Riyanti, Ngadiman & Hamidi (2019). They concluded there were positive and significant influences between metacognitive awareness and the learning outcomes.

The analysis of the MRST and metacognition questionnaire found three students' categories in the experimental group. The first category referred to students who could do all mathematics representation aspects properly (the reflective use category). The second category referred to students who could do mathematics representation aspects although something was missing out (the strategic use). The third category referred to students who sufficiently could do all aspects (the aware use category). The fourth category referred to students who met the minimum criteria to work on an aspect. Here are the descriptions of the students' mathematics representation ability in various metacognitive categories.

The Mathematics Representation Ability based on the Reflective Use Category

Based on the analysis of the metacognition questionnaire sheet and the interview, there were three students categorized as reflective use students. They met the criteria of metacognitive regulator categories. It was in line with a study by Sophianingtyas & Sugiarto (2013). They concluded that the students' levels with high metacognition were the reflective use, typed students. It was also in line with Safitri & Saleh (2015). The initial MRST and final MRST of the groups were 71.33 and 80.67.

The students used their reflective thinking during, before, and after the process to solve the problems. They considered the achievement and how to improve it. They checked the answers after they finished working on them. It was in line with the findings of Wahyuningsih & Waluya (2017). They found that reflective use students could plan, manage accurate strategy, monitor their jobs, and revise mistakes. It was also in line with Maulyda, Budiharjo, Erfan & Radha (2020).

The finding was supported by the answer sheets of the students. They could identify the data in the questions, know how to solve problems, write the solution clearly, and evaluate their answers. Unfortunately, some of them did not write the questions into accurate mathematics sentences. It was in line with the study of Suryaningtyas & Setyaningrum (2020) and Anggo (2011). They found that students with excellent metacognitive ability could solve problems consciously. They also could manage their thoughts.

The Mathematics Representation Ability based on the Strategic Use Category

Based on the analysis of the metacognition questionnaire sheet and the interview, there were three students categorized as strategic use students. It was in line with a study by Sophianingtyas & Sugiarto (2013). They concluded that the students' levels with moderate metacognition were the strategic use-typed students. It was also in line with Safitri & Saleh (2015). The initial MRST and final MRST of the groups were 61.78 and 70.33.

There were nine students with moderate metacognitive ability. They could complete the mathematics representation questions and apply their strategies properly. However, some of them could not re-check their answers. They used their strategic thoughts to solve problems. It was in line with Wahyunigsih & Waluya (2017). They found that strategic use-typed students could plan, manage the proper strategies, monitor, and realize their mistakes. However, they had not been able to revise their works. It was also in line with Maulyda, Budiharjo, Erfan & Radha (2020).

The finding was supported by the answer sheets of the students. They could identify the data in the questions, know how to solve problems, and write the solution. However, they could not evaluate their answers. It was in line with Suryaningtyas & Setyaningrum (2020). They concluded that not all students with moderate metacognitive ability could apply the ability to solve problems.

The Mathematics Representation Ability based on the Aware Use Category

Based on the analysis of the metacognition questionnaire sheet and the interview, there were three students categorized as aware use students. It was in line with a study by Sophianingtyas & Sugiarto (2013). They concluded that the students' levels with Low metacognition were the aware use-typed students. It was also in line with Safitri & Saleh (2015). The initial MRST and final MRST of the groups were 51.75 and 61.75.

Four students with low metacognitive ability could not complete the questions. They were confused while reading the problems so their solution stages were recklessly done. They used their thoughts without realizing how to solve problems. It was in line with Suryaningtyas & Setyaningrum (2020). They concluded most low-cognitive ability students did not apply their metacognitive ability to solve problems.

The finding was supported by the answer sheets of the students. They could not identify the data in the questions, know how to solve problems, and write the solution. They even left the sheet blanks. Students with aware use ability could identify the questions but they were lack of analyzing and evaluating ability on their answers. It was in line with Wahyuningsih & Waluya (2017). They stated that the aware user typed students could conduct planning, based on the highest planning score; they could arrange strategies although they were not accurate and had low scores during the monitoring stage. It made them realized their mistakes in the evaluation stage. However, they could not revise their works.

CONCLUSION

Based on the findings, the average scores of the students' mathematics representation ability intervened by TTW with MiC approach and verbal feedback assisted by LMS were higher than the minimum mastery standard. The proportion of the experimental group students was higher than 75%. The average score of the mathematics representation ability with the learning model intervention was higher than the mathematics representational abilitie scores of students with TTW learning model assisted by LMS. Besides that, there was an influence of metacognition toward the students' mathematics representation ability. From the three categories, they had similarities on the first component, identifying the given problems. The differences were during the analyzing and evaluating activities. These differences made gaps in the students' mathematics representation ability. In this research, the fourth category, the tacit use students, was not found. It was because the students could at least meet the minimum criteria to work on an.

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