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Metacognition Development Through Stad Learning Assisted With Module by Using Diagnostic Assessment to Improve The Problem Solving Ability

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Abstract

This study has purpose to (1) determine the effectiveness of STAD learning assisted with module by using a diagnostic assessment on the ability of mathematical problem solving, (2) describe the problem solving abilities reviewed from metacognition in the learning model of STAD assisted with module by using diagnostic assessment, (3) find out the results of diagnostic assessments follow up of students problem solving ability in the learning model of STAD assisted with modules. The type of this study was mixed method with concurrent embedded design. The subjects of this study were students of grade XI SMA Negeri 1 Weleri. The results obtained from the analysis were (1) STAD learning assisted with module by using diagnostic assessment is effective, (2) it was found on the pattern of problem-solving abilities that (1) students with high metacognition were able to solve problem in accordance to the step proposed by Polya, (2) most of students with moderate metacognition did not recheck the problem solving, (3) students with low metacognition could not perform the problem solving plan and recheck the problem solving, (3) after conducted summative test, obtained average value of 77.65, this result indicated that most of the students obtained higher score than minimum completeness score.

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INTRODUCTION

Education is one of the basic needs in advancing a nation or state. The curriculum of 2013 is a curriculum that is applied in schools today. The mathematical ability of Indonesian students at the international level based on test results of the IEA through TIMSS is still far behind compared to other countries. In 2015 (Hikmasari, 2017: 216), Indonesia was ranked at 49th out of 53 countries participating in TIMSS. Meanwhile, the result of PISA in 2015 results for mathematics put Indonesia in the 63rd position out of 69 countries.

Problem solving plays an important role in mathematics and must have an important role in mathematics education (Vandiagris, Junaedi, & Masrukan, 2015). Problem solving is the application and concept of skills (Dwiningrat, 2014). Soedjadi (2000) also suggested that problem solving ability is a skill so that students are able to use mathematical activities to solve problems in mathematics, problems in other sciences, and in everyday life problems.

Polya (1985) in his book "How To Solve It" describes in detail four problem solving steps, namely: (1) understanding the problem, (2) preparing a problem solving plan, (3) implementing a problem solving plan, (4) checking the results of the problem solving. Meanwhile, the standard or indicator of problem solving ability according to NCTM are (1) building new mathematical knowledge through problem solving, (2) solving problems that arise in mathematics and other fields, (3) applying and adjusting various kinds of strategies suitable for problems solving, and (4) observing and developing a mathematical problem solving process (Walle, 2008: 5).

From the observations at SMAN 1 Weleri, it was found that students' problem solving abilities were still low. There are several things that cause low problem-solving skills, such as, due to the teachers who are less able to develop the metacognitive abilities possessed by students. This is consistent with the research of Muhammad Ihsan (2016) which states that the effect of metacognition on the ability to solve mathematical problems directly is positive. Metacognition knowledge has the capacity to play an important role in student learning achievement (Amin, 2015: 215).

Metacognition is knowledge about cognition and regulation activities in the learning process. "Metacognition is originally referred to as knowledge about and regulation of one's own cognitive activities in learning processes" (Jaalel, 2016: 165). Conceptually metacognition is defined as a person's knowledge or awareness of his own thinking process, the ability to monitor (monitor) and direct (manage) the processes and results of his own thinking and evaluate the thinking process and the results of his own thinking (Laurens, 2010: 201).

One of learning model that involves the activeness of students during the learning process is a cooperative learning model (Narso, Suyitno, & Masrukan, 2013). STAD is also an effective cooperative learning method and requires student activity. Student Teams Achievement Division (STAD) learning model was developed by Slavin. There are six steps in implementing the STAD model: (a) forming a group of 4-5 people heterogeneously, (b) the teacher presents the material, (c) the teacher assigns the task to the group to be done by group members, the members have understand can explain to other members until all members in the group understand, (d) the teacher gives quizzes / questions to all students, when answering the quiz each may not help, (e) evaluating, (f) conclusion (Arisandi, 2015).

Modules are teaching materials that are arranged in a systematic and interesting manner that includes the contents of the material, methods, and evaluations that can be used independently. Learning by using modules aims: (1) students are able to learn independently or with the help of teachers to a minimum, (2) the role of the teacher does not dominate and is not authoritarian in learning, (3) trains student honesty, (4) accommodates various levels and speeds of learning students, (5) students can measure their own level of mastery of the material being studied (Tjiptiany, 2016: 1939).

Diagnostic tests are tests that are used to find out weaknesses (misconceptions) on a particular topic and get input about students' responses to correct

their weaknesses (Suwarto, 2013: 190). Diagnostic tests are used to determine elements in a subject that have specific weaknesses and provide tools to find the cause of these deficiencies.

Through the STAD learning model assisted by a module with diagnostic assessment students will become active in learning. In this learning students are given modules that can help students in learning mathematics. In the STAD learning model assisted modules with diagnostic assessment at each meeting diagnostic assessment was carried out. This serves to find out the weaknesses of students.

The formulation of the problem in this study were (1) How is the effectiveness of the STAD learning model assisted with a module byusing diagnostic assessment? (2) How does the description of students' problem solving abilities in the STAD learning model assisted with modules by using diagnostic assessments reviewed from their metacognition? (3) What is the result of the follow-up diagnostic assessment of the students' problem solving ability in the STAD learning model assisted with module?

In accordance to the above problems, the objectives to be achieved were (1) determining the effectiveness of STAD learning assisted with modules by using diagnostic assessment on mathematical problem solving abilities (2) describing problem solving abilities reviewed from metacognition in STAD learning models assisted with modules by using diagnostic assessment, (3) find out the results of the follow-up of the diagnostic assessment of students' problem solving abilities in the STAD learning assisted with module.

METHOD

This research was a mixed method type with concurrent embedded design. This study begins with field observations then collecting quantitative and qualitative data and then analyzing and interpreting data. The study was conducted at SMA 1 Weleri with the study population of students grade XI in the academic year of 2017/2018. The sample of the study sample were 40 students for classes with STAD learning assisted with modules by using diagnostic assessments, and 38 students for PBL classes.

The research data was obtained from the results of the metacognition questionnaire, the problem solving ability test results (TKPM), the results of interview on problem solving ability, observation sheets of learning implementation and the results of diagnostic assessment tests. The results of TKPM as a source of quantitative research data, and data sources for qualitative research were the sheets of students' TKPM answers, the results of the metacognition questionnaire and the results of interview on problem solving abilities. Quantitative data were tested by using normality test, homogeneity test, proportion completeness test, average completeness test, average comparative test, and effect test. Meanwhile, the qualitative data analysis was done by using data reduction, data presentation, and conclusion drawing.

RESULTS AND DISCUSSION

After carrying out research and analyzing the research data, it was obtained information that (1) learning in classes by using the STAD model assisted with a module by using diagnostic assessment was able to deliver students to achieve classical learning completeness with students who achieved completeness of more than 75%, (2) the average problem-solving ability of the class taught by the STAD learning model assisted with module by using diagnostic assessment is 77.65. This value exceeds the KKM determined by the school which is 70, and (3) the average problem solving ability of students in the class taught by using STAD learning model assisted with module by using diagnostic assessment is more than the average problem solving ability in the class taught by using PBL, (4) there is an increase of metacognition in the class taught by using STAD learning model assisted with module by using a diagnostic assessment, (5) there is a metacognition effect on problem solving abilities. Therefore, it can be concluded that learning by using the STAD model assisted with modules by using diagnostic assessments is effective.

STAD learning model assisted with module by using diagnostic assessment requires students to actively learn through tasks that must be completed in groups and individually with assistance from teachers

who demand student activity; this is in accordance to Brunner's opinion. By assigning assignments from the module to students will increase student metacognition. The results of research conducted by Darsono (2018) stated that there was an increase in algebraic problem solving abilities after the use of algebraic modules based on relational thinking.

In addition, teachers are also required to carry out diagnostic tests. Diagnostic tests are used to determine students' weaknesses in understanding the material provided. Since the teacher's main job is the same as the doctor's work, before heal the patient the doctor will look for the cause of the pain suffered by the patient through intensive examination (Kartono, 2016: 480). Hikmasari (2017) stated in his research that diagnostic assessment is the strategies used to improve student achievement with several different subject areas.

The effectiveness of the STAD learning model assisted with module by using diagnostic assessment in this study was supported by the findings of several previous studies, including the research conducted by Israeni Wage Septrijiwati, I Nyoman Murdiana, and Baharuddin Paloloang which suggested that the STAD learning model improves student learning outcomes and activeness. In addition, from the results of the research by Laksana, R.A.T, Rochmad, and Kharis, M (2013) it was concluded that problem solving abilities increased in STAD learning.

Based on the results of the metacognition questionnaire that measures students' metacognition abilities, 10 students out of 40 was classified as students with high metacognition, 22 students were classified as students with moderate metacognition, and 8 students were classified as students with low metacognition. The discussion of problem solving abilities for each group is described as follow.

The Problem Solving Ability of Group with High Metacognition

From the results of TKPM before and after STAD learning model assisted with modules by using diagnostic assessments for high metacognition group students have increased. The increasing of students' problem solving abilities in high metacognition groups is not too significant. This happened since basically students with high metacognition already have high problem solving abilities.

From the results of the TKPM answers and the results of interviews with subjects 1 (A1) and subject 2 (A2), it can be concluded that in general students have been able to understand the problem, compile a problem solving plan, implement the problem solving plan, and re-examine the problem solving.

The Problem Solving Ability of Group with Moderate Metacognition

From the results of TKPM before and after STAD learning model assisted with modules by using diagnostic assessments for students A3 and A4 have increased. This happened since students with moderate metacognition in STAD learning model assisted with modules by using diagnostic assessment are required to be active in learning activities. This is consistent with the results of research of Bedrial Rahmat NZ, Armiati, and Nilawasti ZA (2012) which stated that there was an increase in student activity during applying the STAD learning model.

From the results of the TKPM answers and the results of interviews with subject 3 (A3) and subject 4 (A4), it can be concluded that in solving the problem according to the step of the pattern, there are still some errors. in general, students have been able to understand the problem, prepare a settlement plan, there are several questions that do not implement the settlement plan. Whereas to check the problem solving is still not implemented.

The Problem Solving Ability of Group with Low Metacognition

The problem solving ability of students A5 and A6 is still low. From the results of TKPM before and after STAD learning model assisted with modules by using diagnostic assessments on students A5 and A6 have increased. The increasing of students' problem solving abilities in the low metacognition group happened due to the provision of diagnostic assessments for the students. This is in accordance to the function of the diagnostic assessment, namely (1) identifying problems or difficulties experienced by students, (2) planning further actions in the form of efforts to solve according to problems or difficulties that have been identified (Rositasari, 2014).

From the results of the TKPM answers and the results of interviews with subject 5 (A5) and subject 6 (A6), it can be concluded that in solving the problem according to the step of the pattern there are

still some errors. Students have been able to understand the problem and compile a problem solving plan. In carrying out the completion plan, students with low metacognition still experience difficulties. Meanwhile, to re-check the problem solving is still not implemented.

In this study, a diagnostic assessment test was given at the end of the study. From the results of the analysis of the diagnostic assessment tests, follow-up of students who have errors. Follow-up given in this study, namely remedial learning. In accordance with the Ministry of National Education (Hikmasari, 2017) forms of remedial learning include: (1) re-teaching; (2) giving special guidance; (3) special training assignments; and (4) utilization of peer tutors.

1st Meeting

From the results of the diagnostic assessment provided in the data that all students can work on the diagnostic assessment correctly. Follow-up given in the form of enrichment.

2nd Meeting

At the second meeting the material taught was the position of the point against the circle. From the results of the diagnostic assessment that was given in the data that there were two students who were wrong working on problem number 2 and two students who were wrong working on problem number 3. Follow-up provided in the form of:

Table 1.

No.	Subject	Number of error	Follow-up
1	X21	2	Giving a certain assignment task
2	X22	2	Giving a certain assignment task
		3	Giving a certain assignment task
			Giving a certain assignment task
3	X23	3	Giving a certain assignment task

3rd meeting

At the third meeting the material taught was the position of the line towards the circle. From the results of the diagnostic assessment that was given in the data that there were three students who were wrong working on problem number 2 and two students who were wrong working on problem number 3. Follow-up was given in the form of:

Table 2.

No.	Subject	Number of error	Follow-up
1	X 31	2	Giving a certain assignment task
2	X 32	2	Giving a certain assignment task assignments specifically exercis
3	X 33	2 3	Providing a certain guidance
4	X 34	3	Giving a certain assignment task

4th Meeting

At the third meeting the material taught is the position of the line towards the circle. From the results of the diagnostic assessment that was given in the data that there were three students who were wrong working on problem number 2 and two students who were wrong working on problem number 3. Follow-up was given in the form of:

Table 3.

No.	subject	Number of error	Follow-up
1	X41	2	Giving a certain assignment task
2	x42	2	Giving a certain assignment task
3	X43	2	Giving a certain assignment task
4	X44	2	providing a certain guidance

5th Meeting

At the fifth meeting the material taught was the equations of the tangent circle. From the results of the diagnostic assessment that was given in the data that there were four students who were wrong working on problem number 2. Follow-up provided was in the form of:

Table 4.

No.	subject	Number of error	Follow-up
1	X 51	2	assignments specifically exercise
2	X 52	2	assignments specifically exercise
3	X 53	2	assignments specifically exercise
4	X 54	2	providing guidance specifically

The results of the diagnostic assessment follow-up showed a good result on the problem solving abilities. This can be seen from the results of the summative tests given. According to Kartono (2011), summative assessment is an assessment carried out at the end of the program unit with the aim of seeing the results achieved by students about how far the competencies of students and subject competencies are controlled by students. In this study, the summative test aims to find out the problem solving ability of students in circular material. Summative test results obtained by the average problem solving ability of students in STAD learning modules assisted by a module with a diagnostic assessment of 77, 65. The number of students who scored above the passing score was at least 31 students from 40 students. This shows that most students in the research class get more grades than the minimum completeness score.

CONCLUSION

From the results of the research and discussion, it can be concluded that: (1) STAD learning model assisted with module by using diagnostic assessment is effective, (2) found a pattern of problem solving ability, that is, students with high metacognition are able to solve problems according to their step, most of students with moderate metacognition generally do not re-check the problem solving, most of students with low metacognition cannot implement problem solving plans and do not re-examine problem solving, (3) achievement of students' mathematical problem solving ability by using the STAD learning model assisted with modules by using diagnostic assessment, after the summative test obtained an average value of 77.65, this indicated that most students in the research class obtained higher score than the minimum completeness score.

Students metacognition contributes to mathematical problem solving abilities. Therefore, it is very necessary to grow and develop students' metacognition in mathematics learning.

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