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The Effect of Mathematical Disposition toward Problem Solving Ability Based On IDEAL Problem Solver

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Abstract: ***The purpose of this research is to analyze the effect of mathematical disposition component toward problem solving ability of 8th grade students on PMRI (PendidikanMatematikaRealistik Indonesia) learning models based on IDEAL Problem Solver. This research involved 139 students whom are in considered from population of 218 8th grade students by purposive sampling. The endogenous variables were confidence, flexibility, persistent and tenacious, curiosity, reflection, and problem solving ability. The exogenous variables in this research were respect mathematics applications and appreciate the role of mathematics. Research instrument used were 5 items in problem solving ability test and 37 item in mathematical disposition scale. Data was collected by problem solving ability test and mathematical disposition by scale. Data were analyzed with path analysis to obtain knowledge mathematical disposition direct and indirect affect toward student's problem solving ability. Research finding show that (1) confidence (26,4%), flexibility (28,6%), persistent and tenacious (32,5%), reflection (14,1), curiosity (16,9%), and appreciate the role of mathematics (10,5%) affected directly problem solving ability; (2) curiosity (6%) and appreciate the role of mathematics (8,3%) affected indirectly to the students' problem solving ability; (3) respect mathematics' applications had indirectly effect to problem solving ability through confidence (6%), flexibility (1,3%), persistence and tenacious (9,9%); (4) mathematical disposition had an effect on students' problem solving ability at 77,3%.Research findings conclude that mathematical disposition components affected directly and indirectly to the problem solving ability in PMRI based on IDEAL Problem Solver.***

Keywords: mathematical dispositions, PMRI, problem solving, IDEAL Problem Solver

1. Introduction

One of the education problems today is the lack of problem solving skills of students. This is shown by the results of the study Trends in International Mathematics and Science Study (TIMSS) of 2011 classifies mathematical ability junior high students in Indonesian in the low category ranks 38 of 42 countries (Mullis, et al, 2012). This problem needs to be in the spotlight of all parties because 75% or more TIMSS problems in the form of problem solving. This is an indication that the reality on the ground shows that the mathematical problem-solving activities have not been used as the main activity in the learning of mathematics. This is supported by findings in the research of Joseph (2011) which shows that the academic performance of students of mathematics (assessment test semesters) does not show the ability of students to solve the problem.

Branca (1980) suggested that the ability of problem solving is the heart of mathematics. This is in line with the NCTM (1989) states that problem solving is an integral part in the learning of mathematics, so it should not be separated from the learning of mathematics. Mathematical problem solving is a tool used not only to help students develop the ability to think, but also helps them to develop basic skills in solving problems, especially in everyday life (Pimta, 2009).

The purpose of the mathematics courses number 5 according to Depdiknas (2006) for all levels of primary and secondary education is that students are able to have respect for the usefulness of mathematics in life, namely curiosity, attention, and interest in studying math, tenacious and believe in solving the problem. That goal shows that learning mathematics not only aims to develop students in cognitive domains, but also aims to improve the affective domain that can support problem-solving abilities. The results of the study Joseph (2011) concluded that in future mathematics assessment should not on the written test analysis but analysis of increasing affective students also need to be done. NCTM (1989) stated that the attitude of the students in facing of mathematics and beliefs can affect their achievement in mathematics.

Mathematical disposition is the affective domain plays an important role in the learning of mathematics. According to the research Gregg (2005), students prefer learning refers to extracting knowledge because they are more convincing sense of learning mathematics. Confidence that empowers students may affect the ability of the learner assessment, the willingness to do the work, and ultimately the mathematical disposition. Disposition is defined as the tendency to view mathematics as something that can be understood, something useful mathematical sense, believe that diligent and tenacious effort in learning mathematics will produce results, and acts as an effective students (Kilpatrick, Swafford & Findel, 2001). Most of the students of SMP Negeri 1 Pecangaan tend to have difficulties when entering the material geometry. Students tend to have difficulty when solving word problems related to the material and beam cube that demands for higher-level thinking on the problem solving aspects.

According to Aydin et al (2007), many students have difficulty and showed poor performance in geometry class

in middle school and high school. Solutions to these problems either by making changes in learning and searching for a suitable strategy in order to improve the problem solving skills of students. These changes can be done by increasing the affective domain of students in the learning of mathematics. Not only cognitive capabilities of students, affective factors also have a major effect on problem solving ability students (Furinghetti and Morselli, 2009; Caballero et al, 2011).

Innovation mathematics learning is done by selecting model PMRI mathematics learning so as to improve the mathematical disposition of students in mathematics learning, which in turn will enhance the ability of solving problem anyway. One of the advantages of the approach as proposed PMRI, Wijaya (2012) is emphasized learning by doing, in accordance with the basic concepts of mathematics realistic learning.

Along with the need for strategies in solving problems, Bransford and Stein in 1984 introduced the IDEAL Problem Solver. Specifically IDEAL Problem Solver can be used to resolve problems with a well-defined problem (well-structured problems). A step in the IDEAL Problem Solver is as follows: (1) identify the problem, (2) defining the goal, (3) explore solutions, (4) act on strategy, and (5) look back and evaluate the effect (Bransford and Stein, 1993).

Based on the above background, the purpose of this study is to analyze the disposition effect on the problem solving ability of eighth grade students on PMRI learning models based IDEAL Problem Solver.

2. Method

This research was a quantitative approach that uses path analysis to determine the most influential mathematical disposition either directly or indirectly to the problem-solving ability of eighth grade students of SMP Negeri 1 PecangaanJepara on the cube and the cuboid material. Selected sample of 139 students with a purposive sampling technique from 218 students. Endogenous variables in this study are confident in using mathematics, flexibility in working mathematics, persistent and tenacious in doing mathematical tasks, have a curiosity, to reflect on the thinking and self performance in learning mathematics and problem solving skills. While the exogenous variable in this study is to appreciate the application of mathematics and appreciate the role of mathematics.

Data was collected by conducting a test-based problem-solving ability by IDEAL Problem Solver and scale mathematical disposition. Before the tests carried out, need to teach mathematics by PMRI learning model in main material cubes and cuboids. Steps to resolve the problem solving by IDEAL Problem Solver also introduced to the students because they had not previously familiar with the model. The tryout of solving problem ability test to determine the validity, reliability, level of difficulty, and distinguishing test items. Having analyzed with these tests, taken five questions that fit the criteria for evaluating students in the sample group. Before the instrument scale mathematical disposition given to the students, first carry out the tryout test of instrument scale mathematical disposition instrument, then analysis of the validity and reliability of the instrument.

Problem solving ability test given after learning PMRI based IDEAL Problem Solver. Students have to solve 5 questions of problem solving ability test within 60 minutes by using the IDEAL Problem Solver steps. Scale mathematical disposition in the form of a questionnaire with a 4-level Likert scale. A total of 37 point mathematical disposition scales completed by the students after solve all questions in problem solving ability test. The next step is to analyze the data of problem-solving ability and mathematical disposition by using path analysis.

3. Result

This study used path analysis to determine the most influential mathematical disposition components either directly or indirectly to the problem solving ability of students. Based on calculations using SPSS showed that the data were normally distributed, there was no multicollinearity, autocorrelation, and heteroskedastic.

Figure 1 shows how the disposition component affects the problem solving ability, either directly or indirectly.

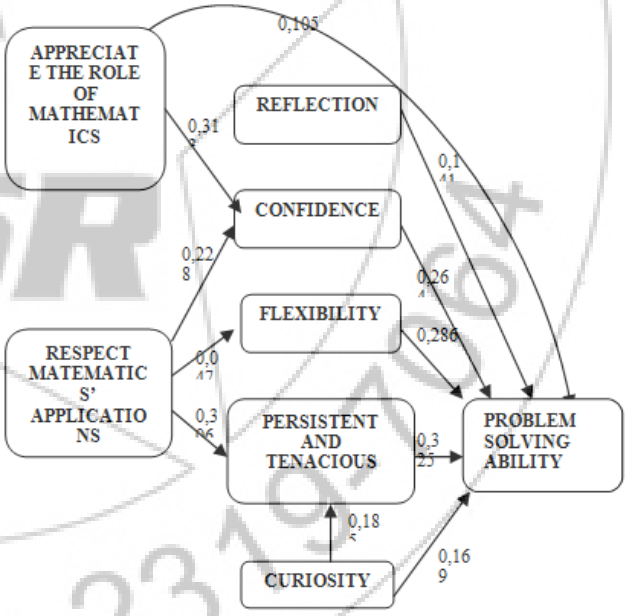

Figure 1: Line Diagram of Mathematical Disposition Components Affecting Problem Solving Ability

1. Confidence (26,4%), flexibility (28,6%), persistent and tenacious (32,5%), reflection (14,1), curiosity (16,9%), and appreciate the role of mathematics (10,5%) affected directly problem solving ability.
2. Curiosity (6%) and appreciate the role of mathematics (8,3%) affected indirectly to the students' problem solving ability.
3. Respect mathematics' applications had indirectly effect to problem solving ability through confidence (6%), flexibility (1,3%), persistence and tenacious (9,9%).

4. Mathematical disposition had an effect on students' problem solving ability at 77,3%.

4. Discussion

1. Disposition was positive influence on mathematical problem solving ability at 77.3%, while 23,7% was for other factors that were not involved in the research. In this case if the students have positive disposition then mathematics problem solving ability will increase. Mathematical disposition should be increased because it is the most important factor in determining the success of students (Kilpatrick et al, 2001). It also related to the results of research of Prasetya et al (2012) which stated that learning with IDEAL Problem Solving charged mathematical disposition has positive effect on problem solving ability of students.
2. Confidence in solving problems was the positive direct effect on problem solving ability at 26.4%. This means that if the students' confidence increases, the problem solving ability of students will also be increased. Martyanti (2013) states that students gained confidence when students solve problems and after successful solve the problem. Confidence of students in PMRI showed when students were not afraid to follow the lessons, optimistic to solve the problem solving, dared to ask the teacher if there was question not yet understood by students, and take upon to say opinion. This is consistent with the characteristics of realistic mathematics learning according to Bakker (2004) was centered on the students so that they were confident actively involved in class discussions though agree or disagree with his solutions, inquire alternative solutions, and reflect that solutions. With the self confidence, the students will be more motivated and love to learn math. Therefore, self-confidence needs to be owned and developed by each student.
3. Flexible in looking for ideas and trying various alternative answers was the positive direct effect on problem solving ability at 28.6%. Taplin (2010) revealed that the problem solving approach is an approach that encourages flexibility, the ability to respond to unexpected situations that do not have immediate solutions, and to develop perseverance in facing the problem. Problem solving approach can provide a vehicle for students to develop their own ideas about mathematics and to take responsibility for their own learning. IDEAL problem solver is a dynamic problem solving step which can make students more competent because students have a more structured internal procedures from the beginning. IDEAL problem solver makes students can select and develop ideas so that students can formulate, approach, and solve problems.
4. Persistent and tenacious in doing the task was the positive direct effect on problem solving ability at 32.5%. These disposition components that have the greatest influence among other disposition components. This means persistence and tenacious was key of problem solving in PMRI based on IDEAL Problem Solver. Problem presented in PMRI oriented issues related to problems in everyday life. Therefore, the students feel excited and not easily discouraged in solving problems. The IDEAL Problem Solver steps help students to solve problems in a systematic and planned.

Student's worksheet with PMRI models in this study provide group and individual tasks that must be completed with the steps IDEAL Problem Solver, which stimulates students to solve problems were fun in their own way and not cheating other work friends. Intensity ask the teacher and participation in the group is an indicator of the persistence and tenacity of students. This shows that the principle activity RME principles for students to actively resolve the problem solving.

5. Curiosity was the positive direct effect on problem solving ability at 16.9% and indirectly affected by 6%. PMRI initial activity, learning begins with a realistic problem that motivated and helped students to learn math (Marpaung, 2010). Learning PMRI based IDEAL Problem Solver can stimulate students to have a great curiosity so that students will be persistent and tenacious search for solutions to mathematical problems encountered. Curiosity in learning mathematics not only appears when solving problems, but also come up with a way to find information on other sources and trying to learn on their own material that has never been taught by a teacher.
6. Reflections on how to think and self-performance direct was the positive effect on problem solving ability at 14.1%. Reflection in learning PMRI that was students associate mathematics new material with material that has been previously learned and apply it in real life. Students engage in interactive, explain, and justify their work to solve contextual problems, understand his work, explaining in class discussions about his attitude to agree or disagree with his solutions, inquire alternative solutions, and reflect that solutions. One of the group explains the discussions result in front of class and other groups to compare their answers. In this way students can reflect on themselves and the group's performance.
7. Appreciate the applications of mathematics in other field of everyday life does not significantly affect the ability of solving problem students. This was because it takes a relatively long time to develop students beliefs that mathematics was useful in everyday life. Appreciate the applications of mathematics in other areas of daily life needs to be invested to early students. Appreciate the applications of mathematics in everyday life was indirectly affect to problem solving ability mediated by confidence, flexibility, and persistence and perseverance in doing the task. Appreciate the application of mathematics does not grow instantaneously but beliefs in the students must be grown for a long time. Belief that mathematics can help solve everyday problems can be grown by digging through the knowledge of contextual issues in accordance with the character of the phenomenological exploration on RMRI.

Learning with contextual issues will be easily understood, giving rise to the students beliefs to be able to solve the problem-solving. Respect in other fields of applied mathematics is able to make a flexible attitude in looking for ideas to solve problems in everyday life. Problems in other areas will be able to be completed quickly and accurately by students not only one way, but in many various ways. Not only self confidence and

flexibility, persistence and tenacity students are also affected by the appreciation of mathematical applications. Students who have a high confidence of the usefulness of mathematics will increasingly make students more enthusiastic and unyielding in learning mathematics. Their persistence will pay off in the future, not only in mathematics but in other fields and everyday life.

8. Appreciate/respect the role of mathematics in other field and daily life are mediated by confidence was the positive direct effect to problem solving ability at 10.5%. According to Bakker (2004), one of the characteristics of realistic mathematics learning was intertwining (associations) which states that the inter-section of interrelated mathematics and can be used to solve problems in real life.
   Appreciate/respect the role of mathematics in other field and daily life that mediated by confident was the indirect effect to problem solving ability at 8.3%. Learning mathematics with PMRI models based IDEAL Problem Solver facilitating students to think critically, discuss and dare to argue so as to train students to speak fluently in everyday life and that was makes the students feel confident in solving contextual problems.

5. Conclusion

Mathematical disposition was positive influence on mathematical problem solving ability. Students disposition grow up along mathematics learning and it used to solve not only mathematics problem solving but also to solve daily life problem. Persistent and tenacious were the most influence components of mathematical disposition to problem solving, so teachers can integrate it into activity PMRI based on IDEAL Problem Solver that can enhance student's problem solving abilities.

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