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Analysis of Students' Mathematical Problem Solving Ability in The Topic of Matrix

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Abstract. Mathematical problem-solving ability is one of the important abilities for students that should be achieved. However, some studies show that students are still have difficulty in solving mathematical non-routine problem, especially in the topic of matrix. The deficiency of students' ability can be caused by some sources, such as the text book that be used by students or the teacher and the students' prior learning experiences. Students have difficulty not only in solving the problem but also in understanding the problems, especially in the problems that deal with word problem or real world problem. Therefore, learning that integrates knowledge, skills, and creative thinking and emphasizes more on the experience and active involvement of students in solving problems. This study aims to analyze how students solve mathematical non-routine tasks, espicially in the topic of matrix. The method used in this study was descriptive qualitative. The subjects in this study were 5 students of XI graders of a Vocational High School in Bandung. Data collection techniques used in this study were observation, test, and interview. Based on data analysis, the result of the study shows that students have difficulty in making formula that will be applied in solving the problems.
Keywords: Mathematical problem solving, matrix.

INTRODUCTION ~ Different knowledge beckground of students will bring up the different ways to solve a problem. It is happened because of the environmental factors, included when students learned in the former schools. Students who are independent and successful in solving problems in learning tend to easily solve problems in everyday life.

Mathematical ability is an ability in the academic field which is very important, not only in schools but also in its application in daily life. Mathematics is seen as one of the most important fields because it contributes to the development of science and technology and supports a variety of daily activities of humanity. To face the challenges of this rapid advancement of science and technology as it is today, strong mathematical mastery is needed.

Problem solving is one of the main aspects of the mathematics curriculum that students need to apply and integrate many concepts and skills and make decisions. Problem solving ability is the ability of students to understand a problem, reason, and analyze, choose the right strategy to solve a problem, do calculations, evaluate and reflect on what has been done.

The importance of mathematical problem solving ability is stated by Branca (Krulik and Rays, 1980: 3), namely: (1) problem solving ability is a general goal of teaching mathematics, even as the heart of mathematics, (2) problem solving can include procedure methods, and strategies or ways which is used is the core and main process in the mathematics curriculum, and (3) problem solving is a basic ability that is more meaningful in thinking, and can create strategies for

solving problems later. In addition to this, according to Turmudi (2008) by using problem solving in mathematics, students know how to think, habits to persevere, and high curiosity, as well as confidence in unusual situations, both outside the mathematics grade. So that in daily life and at work, good problem-solving skills can lead to very beneficial things.

Mathematical problem-solving ability was also expressed by Ruseffendi (2006) who stated problem solving is an important activity for students which involves not only one field of study but many fields of study, besides solving problems fostering creative nature, increasing the application of knowledge already obtained, students are able to make analysis, synthesis, are required to make an evaluation of the results and stimulate students to make evaluations of the results and stimulate students to use all their abilities. It is important for students to face their lives now and in the future. Ability to solve mathematical problems according to Polya's procedure (1973). The following are some steps that need to be considered in the problem-solving process, namely: (1) how students understand the problem; (2) how students develop a completion plan; (3) how students implement their completion plans; and (4) how to evaluate results and settlements made.

Broadly stated that the stages of problem solving according to Polya there are 4 steps that are used as a foundation in solving a problem, can be described as follows. (1) Understanding Problems. In the aspect of understanding the problem, students need to identify what is known, what is there, the number, relationships and values related and what they are looking for. (2) Make a Plan. In this aspect, students need to identify the operations involved to solve the given problem. (3) Implement the Plan. In this aspect, the thing that is applied depends on what has been planned beforehand, translates the information provided into mathematical form, and implements the plan during the process and calculation that is taking place. (4) Recheck. At this stage the thing to note is to double-check important information, check all the calculations that have been involved, consider whether the solution is logical, look at other alternatives, and read the question again and ask yourself whether the question has really been answered.

Judging from the taxonomy of learning objectives, Gagne (Russeffendi, 2006) states that problem solving is a type of learning that is the highest level and complex compared to other types of learning. In problem solving, students are required to have the ability to create ideas or new ways regarding the problems they face. Therefore, students have very open opportunities to develop and improve other thinking skills through solving various problems.

Gagne (Russeffendi, 2006) states that there are five steps that must be taken in solving problems, namely:

a) Presenting the problem in a clearer form.

b) State the problem in an operational (workable) form.

c) Arrange alternative hypotheses and work procedures that are thought to be good for use in solving the problem.

d) Test the hypothesis and does work to get the results (data collection, data processing, etc.), the results may be more than one.

e) Re-check (check) whether the results obtained are correct, or maybe choose the best alternative solution.

Difficulties experienced by many students in solving mathematical problems, one of them is because students can not understand the problem they want to do and students do not know the concepts, formulas or facts in formulating story problems into mathematical models, and in choosing and using appropriate settlement procedures. From the explanation above, the root cause of the students 'low mathematical problem solving ability is that students cannot understand the purpose of the problem, therefore students cannot solve problem solving problems, one way to improve students' mathematical problem solving skills by identifying and analyzing students in solving problems mathematical.

The problem formulation of research was how Students' Mathematical Problem Solving Ability in The Topic of Matrix.

METHOD

This research used a qualitative andthe analysis used was descriptive and interpretative. Analysis of test results was used to determine students' mathematical problem solving. Data were collected by using observation, interviews, and tests. The subject in this study were students of grade XI Insan Mandiri Vocational School, Bandung, Indonesia, in the academic year 2018/2019. Samples taken were 5 students.

RESULTS AND DISCUSSION

Based on the results of research that has been carried out in grade XI SMK in the topic Matrix. The indicator used by researchers is an indicator of problem solving ability based on Gagne's procedure which consists of presenting problems in a clearer form, stating problems in an operational form (can be solved), compiling alternative hypotheses and work procedures that are thought to be good for use in solving problems that, testing the hypothesis and doing work to obtain the results (data collection, data processing, etc.), the results may be more than one, checking back (checking) whether the results obtained are correct, or maybe choosing the best alternative solution.

From the results of the study of the five subjects before stating the problem in operational form, the five subjects must repeatedly read the question in question because students are not accustomed to story problems.

Presenting Problems in a Clearer Form

5 selected, some subjects still make mistakes at this stage. The research subject who made a mistake at this stage was S5 making a mistake in question number 5 because it did not write what is known or what was asked on the answer sheet. While S1, S2, S3 and S4 in question number 2 write what is known and what is asked but still experience errors, what is written is not in accordance with the information in the problem. The cause of student error at this stage is lack of mastering the concept of the matrix.

State the Problem in an Operational Form (Solvable)

At this stage only S1 cannot state the problem in an operational form because in question number 5 it does not list the problem to be worked on.

Develop Alternative Hypotheses and Work Procedures that are Estimated Good to Use in Solving Problems

At the stage of preparing the hypothesis, only S1 and S3 carry out the stages well. Mistakes at this stage were made by S2 and S5 making mistakes in questions number 4 and 5. The error is not writing down the strategy / plan that will be used to solve the problem and subsequent errors ie students still do not fully understand the multiplication between the two matrices. That in making a problem solving plan, look for the relationship between the information provided and

the unknown that makes it possible to calculate.

Mentes Hypothesis and Doing Work to Obtain Results

The stage to solve the problem S2 and S5 do it but to get the results wrong, because it does not use the concepts in the matrix material. S1, S2, S3 and S4 reached the stage of solving the problem but in question number 5 encountered an error. The mistake is that students make mistakes in the calculation process and students do not find the results requested in the problem.

Re-check (Check) whether the results obtained are correct, or maybe choose the best alternative solution.

At the stage of re-checking there were no students who reached this stage because the subjects still made mistakes at the stage of checking the answers again. The mistake made is not writing the conclusions of the results of his work, not checking the answers and not carrying out the stages of re-checking.

Of all the stages, the results of research from interviews with students number one about understanding concepts, students are trapped in the material about multiplication between two matrices, it can be concluded that students lack understanding the concept of multiplication between two matrices which is reinforced by the results of students who do not answer question.

From the result, the lack of understanding of mathematical concepts and the rarity of students in solving non-routine problem solving problems makes students get unsatisfactory grades. The lack of problem solving abilities not only happened in elementary school as it stated by Ary Kiswanto Kenedi, et al. (2019) but also in vacational high school as stated ini this research repor. The score of students' mathematical problem solving ability based on the category of initial mathematical ability in this study caan be pesented in Tabel 1.

Table 1. Students' Mathematical Problem Solving Ability

Subject Code	Category	Total score
S1	Low	64
S2	Medium	79
S3	Medium	75
S4	Low	68
S5	Low	54

CONCLUSION

This research has presented an overview of students' Mathematical problem solving abilities on the topic of matrices. Mastery of problem solving skills, among students is still at a low level. Efforts to improve and help students master problem solving skills must be planned and implemented. It is hoped that the data generated by this research can contribute to the improvement of mathematics teaching and learning.

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