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An Analysis of Students' Mathematical Problem Solving Skill in Completing Multiplication and Division of Fractions

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An Analysis of Students' Mathematical Problem Solving Skill in Completing Multiplication and Division of Fractions

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Abstract. The mathematical ability and mathematical problem solving skill can be separated in learning mathematics. In the fourth industrial revolution, one of learning objectives of learning mathematics is the student has a skill in solving mathematical problem. Meanwhile, mathematical problem solving skill can be obtained if the students' mathematical concept understanding is high including multiplication and division of fractions. They stated that understanding fraction concept was very difficult. This study aimed to analyze the student mathematical problem solving skill of the tenth grade of Junior High School in completing multiplication and division of fractions. This research had 8 informants. Data was collected using interview and test and applied qualitative and quantitative analysis. The initial data was obtained from elementary school with three categories of mathematical ability level, namely (1) one student had high skill, two students had moderate skill and one student had low skill. The indicator of mathematical problem solving was based on George Polya (1983) consisting of four steps, they are (1) understanding problem, (2) planning a problem, (3) completing the problem, and (4) rechecking the result. The research result indicated that the student mathematical problem student was low, especially the problem solving of fraction division and multiplication. The student was difficult to make a solving plan. This situation effected on problem solving caused by the indistinctness of problem solving plan or mathematical model and/or mathematical formula about verbal sentence of mathematical problem solving. The result of interview described that the teacher did not explain the ways of completing mathematical problem solving based on G.Polya's steps. In addition, the students were less practice in completing the problem solving questions. Besides, the teacher did not integrate the objectives of basic competence 3 and 4 in each meeting.

Keywords: problem solving, fractions, multiplication and division operation

1. Introduction

Today, the student's problem solving Ability is heard rending because there is no signs of improvement. The result of PISA and TIMSS 2015 showed that the Indonesian Student Mathematics Ability was still low [1], [2]. The assessment of TIMSS and PISA is an analysis and implementation of mathematical object in solving the student mathematic problem and their classroom environment. Since 2013, Indonesia curriculum has goal that is in in line with *The Partnership for 21st Century Skills* that there are seven skills needed in the 21st century, such as Critical thinking and problem solving skill [3],[4].Therefore, problem solving is one of crucial skills that needs attention in Learning Mathematics in order to improve the quality of Elementary School.

The low of mathematics problem solving skill was caused by the lack of concept mastery, reasoning skill and student's mathematical connection [5],[6]. It was caused by mathematics learning that developed the problem solving skill did not get attention from the teachers. The Lack of teacher attention of problem solving skill development made the low student problem solving skill. Therefore, to train the student's concept understanding, reasoning and communication skill, the teacher should integrate the basic knowledge competence and basic competence skill in learning, for example, learning multiplication and division operation in fraction number. Thus, the concept learned can be better understood as well as can be internalized in their routine and environment through mathematical reasoning and connection. To internalize the student knowledge in solving problem experience obstacles in learning. Based on the observation result done by teacher in school, found that the teacher did not give steps in solving the problem to the student [7]. According to Polya G (1973), the steps in solving problem involve; (1) Understanding the problem by writing what the student knows from text and what's the question. (2) planning devise, making model, or mathematical patternbased on learned concept understanding and mathematical concept connection, (3) implementation of the plan, solving the problem using model or pattern, (4) feedbacck, return the solving to the problem (conclusion) [8].

One of ways to improve the student problem solving skill, the teacher needs the right learning model.The 2013 curriculum used three main learning models (Permendikbud No. 103 Tahun 2014) that aimed to form scientific attitude, social attitude, and develop curiosity [9]. The three models are Problem Based Learning, Project Based Learning,dan Discovery/Inquiry Learning. The learning model to improve the problem solving skill is Problem Based Learning (PBL) [10]. The problem based learning is designed to help the student to develop their thinking skill, problem solving skill, and intellectual ability. The problem solving skill related to the reality can be integrated to solve the problem and competition. The readiness of the student with the problem in learning can prepare the student mental to face the reality. Therefore, to improve the student problem solving skill, the teacher should give extra attention, above all in choosing the learning model, such as PBL. PBL can show the steps in solving the problem so that the student can be more advanced to complete the daily problem related to the taught concept.

2. Method

This research is qualitative research aiming to analyze the daily problems regarding multiplication and division operation of fraction number. What the phenomena experienced by subject such as attitude, perception, motivation, action, etc. Holistically and descriptively in word and language form and the specific context experienced and use some natural method. What the problem experienced by the student, and what are causes experienced by the studentin solving the problem given according to the research topic.

The type of research used was case study. Case study is a research done intensively, detail, and in-depth to organism, institution, or a certain object. This research was carried out at SMPN 2 dan 3 in Parepare Sulawesi Selatan Indonesia. Research subject used 8 students taken from 16 classes, consisted of 2 students with high mathematics ability, 4 students with moderate category and 2 students with low category.

There were three instruments used in the research. The first was documentation.Documentation used in subject choosing process was based on the national mathematics test result. The second was test. The test covered the daily problem solving skill regarding multiplication and division operation of fraction number. The test was done to determine the level of the student ability in solving the daily problems consisted of two problems, namely multiplication operation of fraction number and division operation of fraction number. The third was interview.It aimed to confirm or ask again the student's question, the problem they know and Difficulty level of items (questions), as well as the cause why the student were difficult to solve the non-routine problem such as the problem regarding daily activities which was a learned concept. Moreover, the question related to the student's perception of the learning done by the teacher and the lecture assigned in the school (PDS lecture). The PDS Program (Lecturer in the School) was carried out for 2 months or 8 weeks. This research used triangulation technique to

make conclusion. It was expected that all data were supporting each other and giving in-depth and detail information regarding the skill in solving the problem concerning multiplication and division operation of fraction number.

The analysis of the problem solving skill referred to the indicators of the problem solving skill stated by Polya namely (1) understanding the problem, (2) devise a plan, (3) carry out the plan, and (4) looking back [8].

Data analysis in this study is based on the following stages:

2.1 Data reduction

Data reduction is the process of selecting, focusing, simplifying, abstracting, and transforming field notes or transcripts. Data reduction is a form of analysis that simplifies, directs, and organizes data so that conclusions can be drawn.

2.2 Data display

Data display is a collection of information that is organized and categorized so that it is possible to draw a conclusion. The data displayed in this study is to classify data about students' mathematical problem solving ability.

2.3 Drawing conclusion

Drawing conclusions in this study are the stage of understanding the patterns, information, and possible arrangements, as well as the causes that arise during the research process. The conclusion of this study is used to reveal the characteristics of mathematical problem solving ability of junior high school students.

3. Result and discussion

There were two problems given to the respondents, they were the concept of multiplication of the fraction number and the concept of division operation of the fraction number. First problem is the concept of multiplication operation of fraction number, “Ani has money as much as Rp 80,000.00. 3/5 from the money is used to buy books and the rest of money was saved. How much money was saved by Ani? Then, the second problem was related to division of fraction number. A mother has 3 daughters. She intends to share a piece of silk cloth with length $9\ ^{2}/_{3}$ meters. Each her daughter gets same length”. Determine the length of each cloth.

Based on the respondent written response referring to the problem solving with Polya steps, it was generally good but in making the completion model was still more incorrect than correct. Therefore, this problem solving still has obstacles so that the conclusion is also incorrect. After confirming the student work through interview, questionnaire about are the questions difficult? Generally, they assumed that it was difficult but they who have high learning result. The other question, “Do you ever complete the similar question? There were 6 from 8 respondent answered “ever”, but it was begun by how to solve the problem, how the steps were? In addition, the student was less getting guidance from the teacher. Generally, the student cannot make completion model. It was caused by less concept understanding regarding the concept fraction number operation. Moreover, they also were difficult to differentiate the problem regarding multiplication and division operation of fraction number as well as how to integrate. If analyzed further, the learners/students were less practice in connecting mathematics, less understanding to the relation between related to concepts.

Furthermore the way of student learning is not trained to use high-level thinking; consequently solving the daily problems associated with the concept becomes weak. Therefore it is necessary for teachers to familiarize the students with high-level thinking through learning, which gives a lot of questions, with question words; why, what is it, then how is the way out, and so on. However, it is still realized that the teacher and myself, as PDS teachers, still need a lot of training for students to solve problems related to the concepts taught, in this case learning related to KI 4, this needs to be emphasized. Weaknesses in this study include the initial material on the learning of PDS lecturers, including me, so that if the way of learning is not much attention to problem solving, which was done

by the teacher beforehand. So that students are not accustomed to solving problems such as the polya steps required in this study.

4. Conclusion and suggestion

The results of this study show less encouraging results, namely in general, the ability to solve the daily problems (non-routine problems), which are related to multiplication operations and division operations on fractions classified as weak or low when compared with routine problem solving. This is caused by the learning process carried out by the teacher. That is not training enough students to solve the daily problems (non-routine problems), which are related to the concept being studied. Therefore in this paper suggested in mathematics learning needs to strengthend the development of high-level thinking, through learning by increasing train students on non-routine questions, train critical thinking, train the ability to reason and communicate, and provide opportunities for students to explore his knowledge freely through discussion group learning that is supervised and monitored by his teacher.

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