Mathematical Representation Ability of Students Prospective Math Teacher

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Abstract. This paper discusses about mathematical representation ability of students prospective Math teacher. Math teacher ideally has the ability to integrate mathematical thinking skill in their every learning process. The importance of mathematical representation ability developments are in line with the importance of mathematical competence mastery for the students' life. The use of developing mathematical representations ability are (1) students can present their opinion or idea by verbal, symbol, table, graph and diagram, (2) students canfind the close correlation between the branches of Math. In case mathematical representation ability, it was known that students had understood the concept well but had not been able to give structured and systhematic reason. For the mathematical representation ability, it was known that the lack of two skills is caused by (1) students had not used to give reason correspond to the structured and systemathic concept; they tend to answer it directly by giving direct illustration with numbers. (2) Students forgot the argument stages in explainiing a mathematical concept.

1. Introduction

Math learning has an important role for students to raise their competences. Mendikbud [8] states that math learning is aimed to provide students with not only logical, analytical, systematical, critical, innovative, and creative thinking skills but also teamwork skills.Students prospective math teacher often face a big deal in some mathematical process such as reasoning, non-routine problem solving, and verifying. According to Dubinsky [1], the change from elementary thinking to advanced mathematical thinking involves a significant transition i.e from describing to defining, from convincing to verifying logically based on a definition. The transition process is reputed to be a problem for the students. Tall [13] have done a test towards fresh-students that was excellent in their previous education (senior high school) and it turns out that most of them make mistakes in conception of mathematical concept. According to Tall [12] there are several causes why it was happening, such as: generally, Math instruction, from elementary school to university, may be taught in what is called as *ritual*: "Do this and then do that," and usually the teachers will give appraisal to the students who do as told.

The issue happened to the students of Faculty of Teacher Training and Education of Riau Kepulauan University majoring in Mathematic Education, especially those who took Abstract Algebra course. This course is one of compulsory courses which need advanced mathematical thinking skill and valued 3 *sks*. Prerequisite to take the course is Theory of Numbers and Elementer Algebra The course studies the structure of ring including ring, domain integral, field, ideal, polynomial ring, homomorphism ring and its application. Therefore, it is needed conceptual understanding, formal definitions, mathematical model skills, related theoremas, and mathematical representation.Based on the interview results from several students, obtained informations showed that Abstract Algebra course was a difficult course. The students admited that they found it hard; to understand the characteristics of algebra in form of symbol; to verified the characteristics of algebra; to relate one

concept to another, and to solve Algebra problem if there was no example from the lecturer. It showed that students' mathematical representation ability needs to be improved regarding Math learning in school.

Research problem of this research is: How is the description of Mathematical Representation Ability of student prospective Math teacher in Abstract Algebra course?. The purpose of this research is to know the application of Mathematical Representation Ability of student prospective Math teacher in Abstract Algebra course. It is expected that by studying Mathematical Representation Abilityof the student's prospective Math teacher in Abstract Algebra course, this research can be a reference and discourse for practitioners of mathematics education in their effort of understanding and constructing strategy to improve the Mathematical Representation Ability.

2. Research Methodology

This research is a qualitative study that explores mathematical representation ability of student's prospective math teacher. The subject in this study was a six student prospective math teacher with different mathematical abilitiy. Data were collected from test and interview. The test is a problem about abstract algebra to showing mathematical representation ability of subject. While the interview is focused to explore the constraints wich faced by students in solving the problems given. The test results are presented to the subject as an interview guide to explore potential factors related to the settling of problems. The test is given to the respondent before the interview. The test is then discussed to clarify the error of the subject answering the matter. Furthermore, the interview record is discussed again together with the respondent to reveal the limitations of understanding, misconception, or misinterpretation. The interview result is transcribed and then justified by the subject as a form of data validity.

3. Result and discussion

There are some experts who confronted their ideas about the definitions of "representation", they are Davis in [2], [7], [9], [14]. According to Janvier in [5], a representation could be a combination of something which iswritten in a paper or something which existed in form of a physical object and ideas constructed in someone's mind. In addition, Kalathil and Sherin [6] states in a simpler way that representation iseverything created by students for externalizing and presenting their works. Rosengrant [10] states that some representations aremore concrete and functioned as guidance for more-abstract concepts and supporting-tools in solving problem. In the other hand, in psychology of Math education, representation was a description of connection between object and symbol [4]. In this study, the writer used the definition of representation from Goldin, [3] and Tall [13] because some definition seemed to be more common. Mathematical representation emerged by students was a representation of mathematical concepts or ideas which was represented as their effort in understanding mathematical concepts or in searching for solutions ofthe problem they faced. However, they were expected to find an access to their representation or ideas and to have tools which will significantly widen their capacity in thinking mathematically.

Based on some definitions above, it could be concluded that mathematical representation is arepresentation of mathematical ideas (problem, statement, definition, etc) which isused to communicate students' works result by certain ways as the result of their mind's interpretation. Sumarmo [11] explaines that mathematical representation skills includes: the ability to give example (specimen, example) and non-example as well as picture or illustration (image); the ability to translate statements or mathematical issue to another form (switching representation or translating); the ability to create mathematic model from an object or mathematic process.

3.1 The example of mathematical representation ability.

The first example of mathematical representation ability

Given three sets as follows:
a. set of integers of multiple of three
b. the set of prime numbers divisible by 10
c. the set of squared numbers
Of the three sets above determine whichever set of commutative rings and whichever are not. Include answers along with the correct and logical reasons
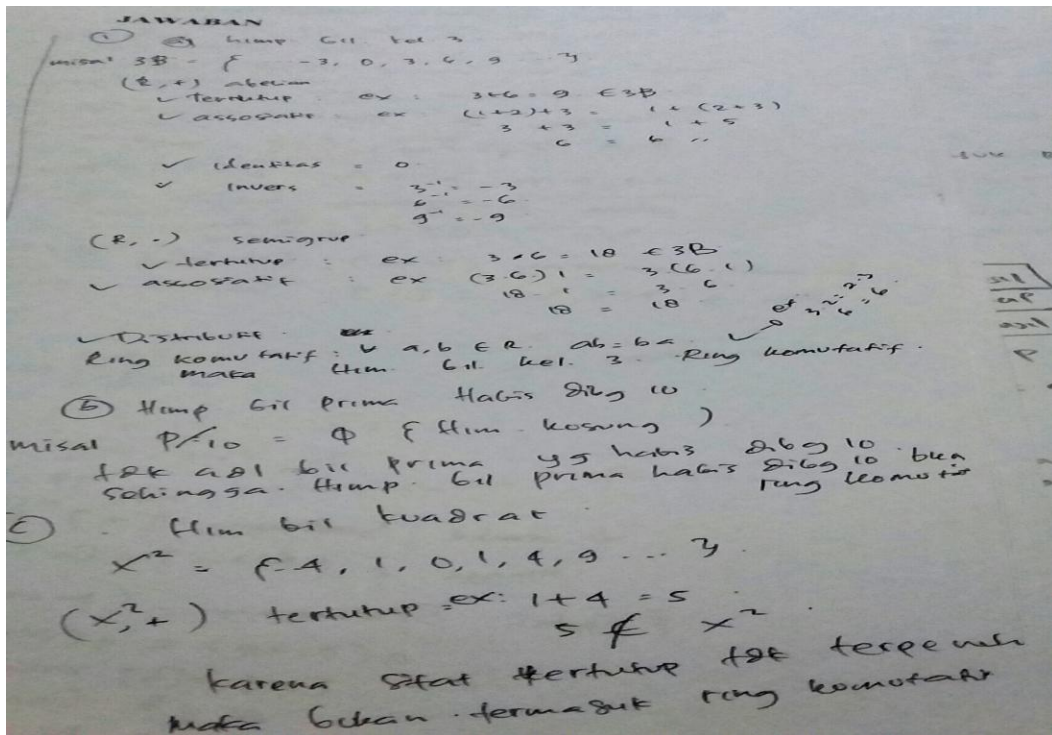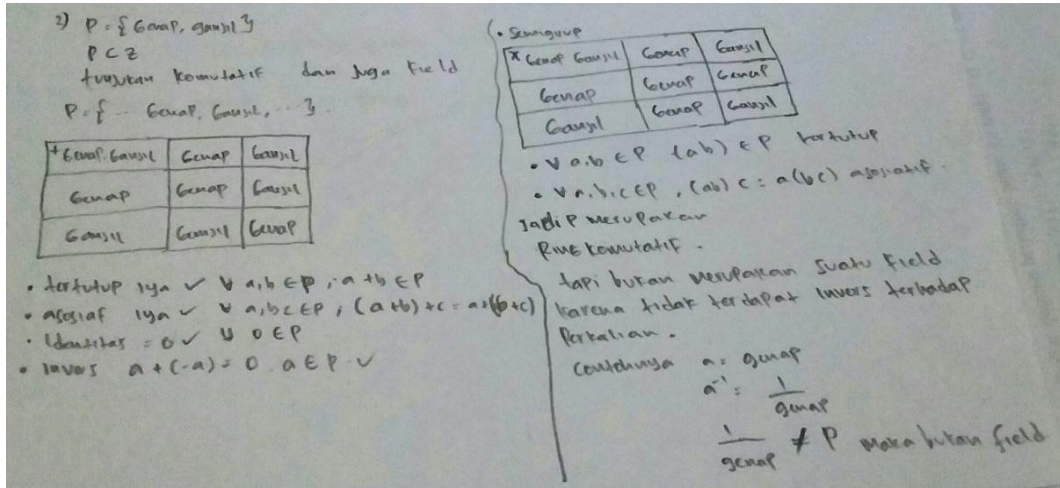

Figure 1. Example of respondent's answer for he first example of mathematical representation ability

One form of mathematical representation skill is the ability to give example and non-example from a mathematic concept. From the given question, students are expected to be able to give example and non-example from the concept of commutative ring. Besides, students are expected to give their correct and precise reason why an association is said to be commutative ring or not to be commutative ring. Based on the given answer, it could be seen that the students are already able to give an example of commutative ring association or non-commutative ring association. Yet, their reasons are not structured and systematic. It is caused by two major reasons: (1) students are not accustomed to provide reason according to the concept in a structured and systematic way; they tend to respond directly by giving a direct illustration with the numbers. (2) Students forget about the stages of argumentation in explaining a mathematical concept (commutative ring).

The second example of mathematical representation ability

Let P = {genap, ganjil} and P subset Z. Show that the elements of "genap" and "ganjil" numbers are a commutative ring, then check whether the commutative ring is a field.

Example of respondent's answer

Figure 2. Example of respondent's answer for the second example of mathematical representation ability

Based on the given questions, students were expected to be able to arrange arguments in order to show that "odd" and "even" numbers elements were one commutative ring. According to existing information, students were expected to be able to check whether the ring was included as a field or not.Based on the students' anwers, it could be seen that the given arguments were not entirely correct. For example, in writing mathematic symbol and argument systemathics students were tend to write the answer based on the spoken language instead of the good written explanation; whether it was in preparing arguments (parts) to show that "even" and "odd" elements are a commutative ring or check if the commutative ring is a field. In fact, there were some students who did not continue their answer to check whether the commutative ring was a field or not. When the students were asked, it was due to two main reasons, they were: (1) students did not used to give the reasons in accordance to the structured and systematic concept; they tend to respond directly by giving a direct illustration with numbers. (2) students forgot the stages of the argument in explaining a mathematical concept (commutative ring). The reasons of students, who did not continue their answer to check whether the commutative ring was the field, were: (1) students forgot the field concept, they just remembered a little, (2) students knew the field concept but they did not know how to give the right answer.

4. Conclusion

Based on the study result, in case of mathematical representation ability, it was known that students had understood the concept well but had not been able to give structured and systhematic reason. For the mathematical representation ability, it was known that the lack of two skills is caused by (1) students had not used to give reason correspond to the structured and systemathic concept; they tend to answer it directly by giving direct illustration with numbers. (2) students forgot the argument stages in explaining a mathematical concept. It is needed a learning design which can facilitate students to develop their mathematical representation ability.

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