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The Development of Reasoning and Proofing Questions in High School Mathematics *(A Need Assessment)*

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Abstract : National Council of Teacher Mathematics (NCTM) explains that reasoning and proofing are the important parts of five standard processes in acquiring and using mathematical skills. Reasoning and proofing are needed by the students to solve both math problems and everyday life issues. However, in fact, the question of reasoning and proofing are rarely given to the students as a means of practicing reasoning and proofing ability. Therefore, the purpose of this study is to describe the needs of teachers regarding the use of reasoning and proofing questions. The method used in this research was descriptive explorative qualitative with participants consists of six high school mathematics teachers. Data obtained by direct interview and indirect interview through social media (WhatsApp). The results shows that there are some reason why the teacher give reasoning and proofing question rarely. It was because the problems of reasoning and proofing that exist in the textbook were still difficult to understand and sometimes give multiple interpretations. Besides, the development of reasoning problems and verifications were still rarely done by the teachers because of the matter of time and the difficulties to develop its questions. Hence, development of reasoning and proofing question can be an alternative to assist teacher's necessity of reasoning and proofing question.

Keywords : *reasoning and proofing, mathematics.*

INTRODUCTION

The curriculum is fundamental to education. The curriculum becomes the basis for the whole learning process which will take place. Mathematics is one of the important subjects in the curriculum of education in Indonesia, it is proven in all levels of education ranging from play groups to high school Mathematics still delivered. The curriculum in Mathematics learning is directed to improve life skill, especially in building reasoning, problem solving and communication. The purpose of this Mathematics curriculum is in line with the standard of Mathematical process presented by the National Council of Teacher Mathematics (NCTM) that the standard of Mathematics learning process includes problem solving, reasoning and proofing, communication, connection, and representation.

Some research in Indonesia aim to measure the ability of school mathematics, hopefully with the acquisition of research results it can be the basis of suggestions for policy improvement in the learning process future. However, studies related to reasoning and mathematical proofing are still rare in comparison with studies that measure other competencies such as problem solving and other abilities. In fact reasoning ability and proofing is a competence that is not less important than the ability of others. Reasoning and proofing is required by students in solving problems both Math problems and issues of everyday life. Latifa (2017)states that mathematical reasoning and proofing can be an alternative in developing and expressing broad understanding and phenomena.

The result of the recent TIMSS research shows that students 'reasoning ability is still relatively low from the total score of 44, Indonesian students only reach 20. While the result of PISSA research in 2015 shows that Indonesian students' mathematics ability is ranked to 63 of 69 countries that participate. Existing research also reveals that reasoning and proofing ability is still low. Students still have difficulty in writing formal proofs and writing their reasoning systemetically and students' knowledge of mathematical definitions and theorems. The results of Marfi's (2016) study also inform the students' misconceptions in reasoning include misconceptions about the meaning of the problem, the error of using the formula, the error in performing the counting operation, the incomprehension of the concept, and the difficulty of writing reasons in writing. As a solution to the problem the researchers and teachers continue to try to design a learning process that is able to hone students' reasoning and mathematical proof.

The development of the learning process in the class is not line with the existence of the instrument of questions that really fit and reveal the students' reasoning and mathematical proof. Zulkardi (2017) discloses that the availability of questions is designed specifically and in accordance with the potential and character of the students so it is assumed that the potential students using reasoning has not developed to the fullest. That is, the teacher has been trying to present the problem related to the reasoning, but in the reality constraints that result in errors in the process of completion still occur. Therefore, this research isaimed at revealing the importance of developing designing instruments and in accordance with the ability of reasoning and proofing for teachers and related parties.

RESEARCH METHODOLOGY

This study used descriptive explorative qualitative. By using qualitative research the researcher seeks to explore and understand the meaning of a number of individuals or a group of subjects (Creswell, 2015: 4). Arikunto (2010) explain that descriptive explorative research, the researcher attempts to describe a phenomenon and does not intend to test a particular hypothesis but only gives a true picture of the symptoms or circumstances. The phenomenon referred to in the research is the development of the problem of reasoning and mathematical proofing related to the needs of teachers on the problem of valid reasoning and validation. The subjects in this study are eight teachers in five senior high schools in Yogyakarta Special Region. Data collection techniques used are direct interviews with research subjects and interviews through social media (WhatsApp). Interview questions submitted to research subjects are concerned about

1. What is student competency related to reasoning and proofing mathematical ability?
2. Is learning always applied about reasoning and proofing mathematical?
3. If not, what is the reason for not applying the problem of reasoning and proofing mathematical?
4. If yes, how is the application and result of giving reasoning and proofing mathematical?
5. What are the constraints related to the application of the problem of reasoning and proofing mathematical?
6. What is your opinion regarding the application of the problem of reasoning and mathematical proof?

RESULT AND DISCUSION

The results of Math teachers interviews in several schools show that in the learning process, teachers always try to design active and innovative learning so that students gain meaningful knowledge and as a means to train various abilities in school Math curriculum. With this learning planning, students are expected to be able to develop their thinking skill so that they can solve the problem given. However, in the process of learning the teachers provide more questions that emphasize on the understanding of concepts, routine questions and problems related to the national exam while providing questions that train reasoning and proofing is rarely trained. In fact, those questions requires high order thinking skill.

Factors influencing this matter is that teachers consider various ability of students in classes so that when students are given questions of mathematical reasoning and proofing where the problem is classified as HOT (High Order thinking), only some students are able to follow. In accordance with the diversity of students' abilities, teachers emphasize more on the mastery and maturation of mathematical concepts so that the problems of reasoning and proofing are rarely taught and almost ever trained and are merely limited to the problems that contain analytical skills. Another reason and the majority of teachers delivered that the use of the problem of reasoning and mathematical proof in learning takes a relatively long time while the teacher has had its own time estimation to complete the subject matter with the time available, so the use of reasoning and proofing in students can disrupt other Mathematics time allocation.

Several teachers are aware of the importance of mathematical reasoning and proofing and hone those skills by tackling designing problems in accordance with indicators of mathematic reasoning and proofing. Teachers hope that in addition to the students studying in the classroom, they are also able to hone their own skills by learning

the problems of reasoning and proofing through existing references. However, in reality there are still not many references in which include problems that contain mathematical reasoning and proofing. Although there are, sometimes these problems are still difficult to understand and generate multiple interpretations. In addition, references that contain questions of reasoning and proofing are usually special books that are not a must for the students so that the students are distressed to have because of the unreachable price and low motivation to own the book. In essence, teachers have high potential to develop the problem of reasoning and mathematical proof independently. But this is rarely done because of teacher's academic ability they are not competent in of teachers' academic ability they are not competente in making the problems which suit the indicators of reasoning and proofing.

Based on the above explanation, it is known that reasoning and proofing must be enhanced through the problem exercises developed in accordance with the indicators of mathematical reasoning and proof. Problem exercises can be done in the classroom during the learning process and outside the classroom learning activities. Therefore, it highly important to have the availability of relevant, appropriate and practical in obtaining students. The importance of reasoning availability of questions of reasoning and mathematical proofing is not matched by the many references that contain questions of mathematical reasoning and proofing question. Therefore, efforts should be made to overcome this problem and one of the right efforts is developing the problem of reasoning and mathematical proofing.

CONCLUSION

Reasoning and proofing is one of the abilities that has to be trained to the students the goal of mathematical learning. The importance of mathematical reasoning and proofing is consistent with current conditions, where students' mathematical reasoning and proofing are still low. Various efforts were made to train students' mathematical reasoning and proofing. Students' mathematical reasoning and proofing training can be done by providing questions that are designed and adapted to indicators of mathematical reasoning and proofing. Due to the difficulty of developing the problem of mathematical reasoning and proofing by the teacher and the lack of development of the problem of reasoning and mathematical proof that is appropriate, the right solution to over come the right solution to overcome it. Thus, developing the problem of reasoning and proofing can be an alternative to assist the teacher with the needs of the use of mathematical reasoning and proofing.

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