

The Effect of Realistic Mathematics Education Approach Oriented Higher Order Thinking Skills to Achievements' Calculus

A Arnellis^{1*}, A Fauzan¹, I M Arnawa² and Y Yerizon¹

¹Mathematics Department, Universitas Negeri Padang, Padang, Indonesia

²Mathematics Department, Universitas Andalas, Padang, Indonesia

*corresponding author: arnellis_math@fmipa.unp.ac.id

Abstract. The goal of this research is to determine the influence of the realistics mathematics education (RME) approach by oriented higher order thinking skills (HOTS) on the results of students' mathematics learning on the subject of the calculus in SMAN 10 and SMAN 12 Padang. The method used is the experimental research with pre and post-test design randomized control group. The data analysis technique used is the test for normality and homogeneity test followed by using a t-test. The results revealed that there were an increase in student mathematic learning outcomes approach realistic mathematics education oriented higher order thinking skills in class XI MIPA SMAN 10 and SMAN 12 Padang. There is impact-oriented approach to realistics mathematics education approach by oriented higher order thinking skills to understanding student learning in class XI SMAN 10 and 12 MIPA Padang.

1. Introduction

The learning activities are the most important activities in education, which is basically carried out in the formal education that the school although the learning process may be done anytime and anywhere. By doing so, the co-education in schools are able to produce quality human resources. Whether or not the results obtained by the students in the learning activities are in line with the learning and teaching activities. If the learning activities systematic then the process will be good. The learning process effective and efficient also will make student learning outcomes to be increased. The role of educators here are very helpful. Because of the importance of education in life, the educational components such as: curriculum, teacher, student, school facilities and school facilities, family environment and the role of parents to be very strategic in student achievement is well.

One of the problems faced with the education is a matter of the weakness in the learning process, because students are less encouraged to develop the ability to think. In class activities directed at the student's ability to memorize information Students do have a lot of knowledge, but do not seek out the knowledge itself is only waiting for the information presented by the teacher, so that knowledge is not implemented in everyday life and will even more quickly intervening forgotten. According to research conducted by [1], which is explained that learning by rote and procedural skills, if not practiced, then the knowledge learned easily be overlooked in comparison with the knowledge gained through understanding deep.

Based on interviews with teachers SMAN 10 and SMAN 12 Padang that realistic mathematics education approach by oriented higher order thinking skills (HOTS) less applied in learning due to lack of knowledge about how to implement them and the benefits resulting from the method of learning for



learning results obtained by the students. In the learning process the teacher only emphasizes the group discussion method, this led to higher order thinking skills (HOTS) less obtained learners in the learning process. KKM in SMAN 10 and SMAN 12 Padang for mathematics in grade XI MIPA is 80. While there are still many students who score less than KKM, if seen from the average value obtained from mid-term test scores were below the standard expected completeness,

Realistic mathematics education approach that refers to the scientific method. The scientific method is a method used by scientists to find the facts or new theories, which were expected to be capable of thinking creatively. Because in finding the facts or the theory of a scientist is not possible using only low-level thinking skills [2]. In the learning process students are less motivated to develop the thinking ability. In class activities directed at the student's ability to memorize information.

HOTS is the output from the learning outcomes, and one of the things that make a low learning outcomes that is in the use of learning approaches. Teachers often teach using conventional approaches, so the lack of opportunities for students to think further. This makes the inability of students to respond the high thinking-required questions, such as in-depth analysis or reasoning. With the ability to think critically, then students can connect and transform knowledge and experience that already has to think critically and creatively in order to determine decisions and solve problems in certain situations. Based on the results of the above data, researchers interested in conducting further research into the effects of learning realistic mathematics education approaches by oriented higher order thinking skills (HOTS) the learning outcomes of students in class XI MIPA. Based on the above explanation, we would like to investigate: how application realistic mathematics education approach by oriented higher order thinking skills in the SMA 10 and SMA 12 Padang? In detail, how to influence realistic mathematics education approaches by oriented higher order thinking skills towards the understanding of student learning in SMAN 10 and SMAN 12 Padang?

One of the problems faced by the world of education is a matter of the weakness of the learning process. In the learning process students are less encouraged to develop the ability to think. Students do have a lot of knowledge, but do not seek out the knowledge itself is only waiting for the information presented by the teacher, so that knowledge is not implemented a in everyday life and will even more quickly intervening forgotten.

Realistic Mathematics Education (RME) is a learning approach that was developed based on the idea [3]. Mathematics is human activity [3]. The purpose of mathematics as a human activity is the human need to be given the chance to rediscover the ideas and mathematical concepts with adult guidance [4]. According Gravemeijer, there are three main principles RME to be considered in designing learning. RME three principles: (1) discovery guided through the process of progressive mathematization, (2) the phenomenon of didactic, and (3) the establishment of a model by the students themselves. The principle of this RME explained that the students should be given the widest chance to experience the process of mathematical discovery by their selves. Through mathematical, students are given the chance to make the process of rediscovery (reinvention) of mathematical concepts they have learned. There are two things that can be used to implement the principles of the invention in RME. First, from the mathematical knowledge of how a concept found. Means teachers can design learning by bringing student to discover mathematical concepts in question. Second, it provides a contextual problem that has some informal settlement. This settlement will be matematization so as to create a process of discovery [5].

Students solve problems informally using reviews their own language (mathematical horizontal), now aim to use more formal language in this case the language of mathematics to find solutions to problems by using mathematical language students the mathematical process has been moved to a vertical mathematical process. In other words, the phenomenon of didactic principle states that in learning activities with RME approach starting from a contextual problem ultimately that led to the concept of mathematics. A math teacher should be Able to an accommodate informal strategies proposed by students that can be used as a tool to get a formal mathematical knowledge. Through this approach, it is expected be creative because the creative thinking, it can improve students' ability to think critically or often referred to as HOTS. In addition, this approach to mathematics education realistic used in order to improve student achievement, because achievement is one indicator of success in learning.

Learning outcomes are the abilities of the students after receiving their learning experience [6]. High and low results obtained student learning is influenced by several factors, one of which is the use of teaching methods in teaching and learning. Thus, it can be concluded that the teaching and learning of mathematics education realistic by oriented HOTS will be able to maximize student learning outcomes. The ability to think is a process skill that can be trained, meaning by creating a conducive learning atmosphere will stimulate students to increase the ability to think. Therefore, teachers are expected to find a learning-oriented approach mathematical thinking ability of students.

HOTS help the students to learn more in-depth, understand the concept better, be able to distinguish the idea clearly, argue well, be able to solve problems, be able to construct an explanation, be able to hypothesize and understand complex things become clearer. This shows that HOTS can be learned, can be taught to student, and with HOTS by solving ability can be improved. Furthermore it is said that there are differences that tend to rote learning outcomes and learning HOTS that use higher-order thinking. Thinking means using analytical ability, critical, creative, and that kind of intelligence needed in everyday life.

The expert defines HOTS approach and a different viewpoint. HOTS is hard to define, but easily recognizable by its characteristics [7]. HOTS is thinking at a higher level than just remembering facts or retell something audible to others. HOTS requires one to do something about the fact, that is understood, summed it up, connect it with facts and other concepts, categorize, manipulate, putting the facts together in new ways, and apply them in finding solutions to problems [8]. The high level of thinking Occurs when a person obtains new information and stored in memory and associates and or reorganize and expand the information to achieve the goals or find a possible answer in a state of confusion [9]. Of the expert opinions are summarized concluded that HOTS requires a more complex thought processes in a situation or solve a problem.

In education, there are two very simple reasons why HOTS is important, students must first success (achievement) in schools and the students will grow up to be adults who make positive contributions to society [10]. Therefore, HOTS must be trained through a learning process in schools and is expected to be a provision for students to contribute to student achievement. Related to the process of formation, knowledge of mathematics is a human. To be able to use mathematics to understand the environment, we need a high-level thinking skills. At the high school level, one of the subjects that are considered difficult is calculus [11]. Thus, the higher the education level, the complexity of the material will be higher mathematics. This of course requires good thinking skills, which one of them was trained through high-level thinking skills that are taught in the learning process. The question is how to approach math learning oriented student HOTS? To answer these questions. Three strategies that can be used to develop HOTS, namely: (1) providing real-world problems in the classroom; (2) provide an open discussion in class; and (3) guide students conduct investigations and research [12]. In more detail it is facilitated by realistic mathematics educations approach [13].

2. Methods

The method used is pretest-posttest design-Only Control Design [14]. Subjects of our research were the students who study mathematics in grade XI MIPA SMAN 12 Padang. Data were collected from students' written responses to the test questions based on HOTS indicators. Furthermore the data from the pretest and post-test was analyzed quantitatively. Data were collect from the activity of RME in student test sheet was analyzed quantitatively. Data processing is done through the main two stages. The first stage: testing the statistics requirements needed as the basis in the hypothesis testing items, namely normality test the spread of the data and test the homogeneity of variance. The second stage: Whether the hypothesis test the influence of the interaction realistic mathematics education-oriented approach by the high order thinking skills of the calculus topic with a test at the end of learning activity. Data analysis techniques use regression analysis.

3. Results and Discussion

3.1. Results

Based on the study of theory of the superiority of realistic mathematics education approach by oriented higher order thinking skills is about the learning process is designed so that learners are actively to construct concepts, principles or characteristics of RME. Thus, the students have a high level thinking skills, such as the ability to solve problems, critical thinking, and creative thinking in following the prescribed lessons, especially on the topic of calculus. To see results calculus students learn the experimental class (SMAN 12 Padang) and control class (SMAN 10 Padang) given pre-test and post-test. Before analyzing the results of the study calculus students do first test requirements are: test for normality and homogeneity of variance. Normality test is done to test the results of studying calculus done using the Kolmogorov-Smirnov test with a significant level $\alpha = 0.05$ tested with SPSS. Data is said to be normally distributed if the value of greater significance of $\alpha = 0.05$. Based on data obtained shows that the significance of the pre-test value of 0.164 experimental class and control class is 0.164, then $\text{sig} > \alpha$ is $0.164 > 0.05$ and $0.164 > 0.05$ means that the value data pre-test experimental classes and control classes normally distributed.

Furthermore, the calculation results can be seen homogeneity test results pre-test experimental class and control class at 0.861 with the meaning of both values have the same variant or homogeneous. Homogeneity test posttest experimental class and control class at 0.219 which means that both variants have the same value or homogeneous. The next stages of data analysis t-test after test prerequisite up finish. Based on the pre-test students' experimental class (class uses RME approach by oriented HOTS) and control classes (classes that do not use RME approach) can be identified significance value $0.398 > 0.05$ means that there are no differences in the ability of students experimental class (class which uses RME approach by oriented HOTS) and control class before the application of RME approach. Based on the post-test graders experiment and control class can be identified significance value $0.00 > 0.05$, the which means that there are differences in the ability of the experimental class students (the class that uses RME approach oriented HOTS after application of RME approach compared to the control class (class who do not use RME approach).

3.2. Discussion

Based on the results of experimental research for six sessions seen various phenomena. The students who have been high ability, ranging willing to exchange information with other students, who had more individualistic. Student learning outcomes in general has shown satisfactory results. In the learning process, students undertake a series of activities independently. They learn on their own without prompting by the teacher. Students solve problems before the teacher gives instruction. This indicates that students are highly motivated to learn math.

Students who have low ability, still be waiting orders from teachers to perform mathematical activity. Conditions like these students cannot learn independently, and must be accompanied by a teacher during the learning process and guidance of teachers are still needed step by step. By the implementation of RME approach by oriented HOTS, the role of teachers and students change from teacher to student center. Because the devices use on RME approach requires that the most important students' mental activity. Positive attitude the students grow up with a way to show the topic with interesting subjects, creating a learning environment that is democratic, applying a number of rules in the activities of students in learning. Learning to stimulate activity, both mental activity and physical activity,

After testing the hypothesis then from the analysis that has been done to answer the problem formulation of the proposed research, the use of RME approach by oriented HOT learning calculus topics give new nuance for students to learn mathematics. In accordance with the philosophy of RME developed based on ideas or views Hans Freudenthal: (1) mathematics must be related to reality; and (2) mathematics as a human activity. On- RME approach by oriented HOTS contains mathematical problem-oriented students of real life problems where the problems which have contained clear to students. Math should be attributed significantly to the context of daily life of students as a source of

development and application through mathematical process [14]. This mathematics process was initiated from contextual issues, topics calculus trying to elaborate the language and symbols that made it self, then resolve concerns be raised. The use of RME approach is easy to implement HOT both teachers and students. Concerns raised were very helpful and understanding to stimulate the students to discover concepts of calculus. Questions tiered loaded on every issue bridges of understanding students to discover concepts.

4. Conclusion

We concluded that the results of the overall study better after applying realistic mathematics education approach by oriented high order thinking skills. The the test scores of student learning outcomes on the topic of calculus showed that the average value of the experimental class is preponderant than the average value of the control class after being given treatment. Where the results of the post test experimental class students and grade control can be identified with significance $0.00 > 0.05$.

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