



THE ENHANCEMENT OF MATHEMATICAL CRITICAL THINKING SKILLS AND SELF-EFFICACY AT SENIOR HIGH SCHOOL STUDENTS THROUGH LEARNING- BASED PROBLEMS CONTEXTUAL MODEL

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Abstract

Critical thinking skills of mathematics (KBKM) and self-efficacy (SE) of math students is still relatively low. This is due to the learning of mathematics in the classroom monotonous, so that students feel bored in learning mathematics, students' passive learning, and students are not self-sufficient in constructing knowledge and untrained students develop thinking ability. Learning model that predicted either to be applied to the study of mathematics and in order to encourage the emergence KBKM and SE math student is problem based learning model contextual (PBMK). The purpose of this study is to improve KBKM and SE mathematics students through the application PBMK models. This research uses experimental design pretest-posttest control group design. The study population was all students in grade X SMAN 3 Kendari, samples were taken two classes by using purposive sampling and determination of the experimental class and control class chosen randomly. Students got a model experimental class and control class PBMK receive direct instructional model (PL). The research instruments used were pretest and posttest for KBKM, SE scale and observation sheet. Data were analyzed by descriptive qualitative, t-test, analysis of randomized block design, and multivariate analysis. Based on the results of data analysis can be concluded that overall, KBKM and SE mathematics students who obtain PBMK models increase significantly higher than students who received the OT. Based on prior knowledge of mathematics students, the average increase KBKM and SE math students by category PAM (high, medium or low), which received a model PBMK higher than the average increase in KBKM and SE math students by category PAM (high, medium or low) who got the OT model. The results of the analysis of observational data indicate that the models PBMK can improve the students' learning activities.

Keywords: Mathematics critical thinking skills, self-efficacy and problem-based learning contextual.

A. Introduction

Kurikulum Tingkat Satuan Pendidikan (KTSP) or Unit Level Curriculum (SBC) states that learning mathematics is expected to acquire the ability to reason, as reflected by the ability to think logically, critically, systematically, and have an objective nature, honesty, and discipline problems. Thus, mathematics is something that needs to be owned, understood, and was developed by students as a means to help them in their daily lives (tools of solving problems) as a form of mathematical literacy. According to the OECD (2013: 25), mathematical literacy is an individual's ability to formulate, implement and interpret mathematics in various contexts, including the ability to perform mathematical reasoning and use of concepts, procedures, and facts to describe, explain or predict phenomena/events. Mathematical literacy helps a person to understand the role or usefulness of mathematics in everyday life as well use it to make decisions right as a citizen to build, caring, and thinking.

The ability to think mathematically in particular high-level mathematical thinking is very

necessary for a student to solve problems encountered in daily life. Therefore, the ability to think mathematically, especially regarding to doing math (math activities) need special attention in the learning process of mathematics. In order to achieve these objectives, the latest issues in mathematics today is developing High-Order Thinking Skills (HOTS), and make HOTS as the main purpose of learning mathematics. The ability to think critically in this case the critical thinking skills of students Indonesia is still low, so that the student is weak in resolving the problems of non-routine associated with constructing and recognize the structure of arguments, the reasons supporting arguments, define, analyze, and think of solutions to problems; simplify, organize, classify, connecting, and analyzing mathematical problems, integrate information and make the connection to draw conclusions. A low critical thinking skill of mathematics was caused by the weak quality of learning mathematics.

Some research suggests that low mathematics students' critical thinking skills are closely related to the quality of teaching of mathematics teachers in the classroom. As stated by Peter (2012) that teachers do not engage students in critical thinking activities to solve complex problems in the real world. Correspondingly, Noer (2009) found in a study of mathematics is still a lot of math teachers who embrace the paradigm transfer of knowledge. In this case the interaction in the learning occurs only in one direction from the teacher as a source of information and students as recipients of information. Students are not given many opportunities to participate actively in the learning process in the classroom, in other words, learning is more centered on the teacher, not the student. Learning math is done nowadays orientation is more the result and not the process.

Based on preliminary studies conducted by researchers at SMA Negeri 3 Kendari in 2013 also showed the critical thinking skills of mathematics students is still low, it is seen from the percentage of each indicator mathematics students' critical thinking skills. In identifying indicators reached 21.74%, 39.67% reaching evaluate, connect only reached 8.65%, troubleshoot reached 17.39% and in analyzing indicators reached 17.12%. In addition, if seen from the attitude of the students in this case self-efficacy is defined as the self-confidence of students, it still looks low. Students feel pessimistic when faced with problems related to mathematics. Students are not confident in solving mathematical problems. Students also feel fear in expressing opinions and asked the teacher if experiencing difficulty learning mathematics. This is in line with the opinion of Bandura (2009: 7) which states that a person with low self-efficacy which easily give up in the face of problems, tend to become stressed, depressed and have a narrow vision of how best to resolve the problem.

An indication of the low critical thinking skills of mathematics and mathematics self-efficacy among students is that students feel bored in learning mathematics, students' passive learning, students are not self-sufficient in constructing knowledge and untrained students develop thinking ability. It shows that not a mathematic which are difficult to study, but due to the applied learning does not match the needs of students and the learning that takes place is not meaningful to students.

The majority of students in the school are not able to make the connection between what they learn and how such knowledge will be used. This is because the way students process information and students' motivation to learn is not touched by the traditional methods of teaching in the classroom. Difficult students understand math concepts taught in an abstract way and lecture so that students need to understand the concepts related to the workplace and the larger society in which they live and work.

Contextual problem based learning model is offered as a holistic learning in education that can be used by all students, both highly talented students and students who have learning difficulties. Efficacy of contextual learning lies in the opportunity given to all students to develop their talents with the expectations and the concept of teaching and learning which enables teachers to associate learning with the real world. Contextual problem-based learning is an educational process that aims to help students see meaning in the academic material they are learning by linking academic subjects in the context of their daily lives, which is the context of the circumstances of personal, social, and cultural development. To achieve this goal the components that must be met are: create linkages-linkages are meaningful, do meaningful work, do a self-regulated learning, cooperation, critical and creative thinking, helps individuals to grow and develop, achieve high standards, and using authentic assessment (Johnson, 2012: 67).

Arends (2008: 43) argues that the problem-based learning can help students develop

thinking skills, problem-solving skills, and skills intellectual in this study the roles of adults with experience through various situations rill or situations are simulated and become students learn independent. The results of problem-based learning are about intellectual achievement that comes from active participation feel meaningful experiences, experiences that strengthen relationships between existing knowledge and new knowledge form relationships. To help students develop their intellectual potential, problem-based learning teaches the steps that can be used in critical thinking and provides the opportunity to use the thinking skills in higher tiers in the real world.

At the most fundamental level in problem-based learning is characterized by students working together in small groups to investigate real-life problems, so that students who feel less confident can ask questions without feeling embarrassed. Students will be easier to explain understanding of the concept to other students or recommend solutions within the group. By listening to other students in the group, students evaluate and formulate their own understanding. They learn to respect the opinions of others because sometimes different opinions proved to be a better approach to this problem. Crawford (2001: 11) argues that when a group working toward a common goal, the students gain experience of working groups have the confidence and motivation higher than students who work alone.

B. Literature Review

1. Mathematical Critical Thinking

Krulik & Rudnick (Somakim, 2010: 41) argues that it is included in the mathematics critical thinking is thinking that tested, questioned, connect, evaluate all aspects of the situation or a problem. In line with these opinions, Somakim (2010: 44) argues that critical thinking mathematically differentiating opinions and facts, conclusions and reasoning, inductive and deductive arguments, as well as objective and subjective. Furthermore, the ability to create questions, construct and identify the structure of arguments, the reasons supporting arguments; defining, analyzing and thinking about solutions to problems; simplify, organize, classify, correlate and analyze mathematical problems; integrate information and make the connection to draw conclusions; further examine the feasibility conclusion, applying the knowledge and understanding gained through new mathematical problems.

2. Self-efficacy

Of the various experts, self-efficacy in practice synonymous with "Confidence" or "Confidence". According Santrock (2011: 363), self-efficacy is the belief that one can master a situation and provide a favorable outcome. In line with these opinions, Bandura (in Feist & Feist 2008: 488) defines self-efficacy as a human belief or confidence in their ability to exercise some control over the function of the size of themselves and events in their environment. Self-efficacy is also the consideration of someone about her ability to achieve the level of performance (performance) are convinced or determined, which ultimately will affect the next action. Keep in mind that self-efficacy is one component of the self-regulated (self-reliance).

Bandura (2009) explains that self-efficacy will influence the actions, effort, perseverance, flexibility in difference, and the realization of the objectives of this individual, so that self-efficacy related to one's ability often determines the outcome before the action occurs. According to Bandura, self-efficacy is the construction of a central in social cognitive theory that a person shall: (a) affect its decision-making and influence the course of action, one would tend to run something when he feels kompeten and confident, and would avoid it if it is not; (B) assist how much effort he is acting in an activity, how long he stayed when in trouble and how flexible in an unfavorable situation for him, in this case the greater a person's self-efficacy, the greater the effort of perseverance and flexibility; (C) affect the mindset and emotional reactions. A person with low self-efficacy which easily give up in the face of problems, tend to become stressed, depressed and have a narrow vision of what is best to resolve the problem while high self-efficacy will help a person in creating a sense of calm in the face of difficult problems or activities.

3. Learning Model with Contextual Teaching and Learning Approach

Berns and Erickson (2001: 3) argues that one of the learning models that use or

association with CTL is problem-based learning (problem-based learning (PBL)), which is a model of learning that uses real-world problems as a context for students to learn through critical thinking and problem solving skills in order to acquire the knowledge and concepts are the essence of the subject matter.

The cornerstone of the philosophy of problem-based learning (problem based learning) is a cognitive-constructivist perspective proposed by Jean Piaget and Lev Vygotsky that students with any age are actively involved in the process of getting information and construct their own knowledge. This knowledge is not static, but constantly evolving and changing for students construct new experiences that force them to base you and modify previous knowledge (Arends, 2008: 47). Selanjutnya based learning contemporary problems also rely on other concepts derived from Bruner, the idea of scaffolding, a process for a student who assisted teachers or people are better able to cope with problems or mastering skills slightly above the level of development at this time.

The core of the problem-based learning is the teacher exposes students to the real-life problem situations (authentic) and meaningful, to facilitate students to break through the investigation/inquiry and cooperation, facilitate dialogue on the various aspects, encouraging students to produce work solving and modeling results. Interest that can be developed through this learning model is thinking skills and problem solving, performance in the face of real life situations, establish autonomous and independent learners.

C. Methodology

This research is Experiment with using a pretest-posttest control group design. A sample of 53 students of class X SMA, divided into one experimental class (27) and one control class (26), selected at random. Experimental class taught by contextual problem-based learning model, while the control class was taught by direct learning model. The instrument used in this study is a test instrument that is test critical thinking skills and mathematical instruments in the form of non-test questionnaire scale of self-efficacy and mathematics student observation sheet activities of teachers and students during the learning process. Technical analysis of the data used in this study is inferential analysis techniques. Data were analyzed quantitatively and to answer research hypothesis. Quantitative data obtained from the analysis of the students' answers on tests of mathematical ability of critical thinking and self-efficacy scale before and after the students got a contextual problem-based learning in both the experimental class and the control class. Quantitative data were tabulated and analyzed using a descriptive analysis of the data and calculate the gain normalized (N-Gain) pretest and posttest. The statistical test used to answer the hypothesis of two different test median, variance analysis with the group randomized design and analysis of variance variable dual bidirectional (two-way MANOVA). Before performing statistical tests, first tested the assumption, which is data normality test using the Kolmogorov-Smirnov test and homogeneity of variance using Levene test.

D. Finding and Discussion

1. Findings

1. Data Analysis of Critical Thinking Ability of Mathematics (KBKM)

- a. Data Analysis of Differences Level of Students' Math Critical Thinking who got PBMK and PL

Based on the test results Independent Samples T-Test obtained t value of 4.804 and a probability value (Sig.) Is 0.000, so H_0 is rejected. Thus, we can conclude that there are differences in the increase in critical thinking skills mathematical significantly between groups of students who received PBMK models and a group of students who received the OT model. Therefore, by looking at the average value of the N-Gain derived from both groups study shows that the average value of the N-Gain students getting models PBMK amounted to 0,509 and the middle category higher than the average value of N -Gain students who got the OT model which only amounted to 0.275 and that are in the low category. Thus, it can be concluded that the increase in critical thinking skills students gain mathematical models PBMK significantly better than students who received the OT model on the whole student.

- b. Differences Increase of Students' Mathematics Critical Thinking Based Early Mathematical Sciences (PAM)

The test results of analysis of variance with a randomized block design showed that the

probability value (Sig.) of treatment 0.000 $\alpha = 0,05$ so that H_0 is rejected. This means that, there is the influence of problem-based learning model contextual and direct learning model to increase critical thinking skills of mathematics in terms of categories of PAM (high, medium, low). Because there are significant PBMK models and models of PL to increase student KBKM terms of categories of PAM, we then test the significance of the difference between the increase in KBKM students who got a model that gets PBMK and PL models for each category of PAM.

Based significance test indicates that the probability value (Sig.) Of all categories of PAM smaller $\alpha = 0,05$ so that H_0 is rejected. This means that the three categories of PAM, students who received PBMK models earned an average increase KBKM which is significantly larger than students who received the OT model.

2. Data Analysis of Students' Math Self-Efficacy

a. Difference of Increase for Students' Math Self-Efficacy who got PBMK and PL

Based on the test results Independent Samples T-Test obtained t value of 4.945 and a probability value (Sig.) is 0.000, so H_0 is rejected. Thus, we can conclude that there are differences in average mathematics self-efficacy increase significantly between groups of students who received PBMK models and a group of students who received the OT model. Therefore, by looking at the average value of the N-Gain derived from both groups study shows that the average value of the N-Gain students getting models PBMK amounted to 0.547 and middle category higher than the average value of N -Gain students who got the OT model which only amounted to 0.364 and middle category. Thus, it can be concluded that the increase in self-efficacy mathematics students who PBMK models significantly better than students who received the OT model on the whole student.

b. Differences Increase of Students' Self-efficacy Based Early Mathematical Sciences (PAM)

The result of analysis of variance with a randomized design showed that probability value (Sig.) Of smaller treatment $\alpha = 0,05$ so that H_0 . This means that, there is the influence PBMK models and models of PL to the improvement of mathematics self-efficacy in terms of categories of PAM (high, medium, low). Because there are significant PBMK models and models of PL to increase student mathematics self-efficacy in terms of categories of PAM, we then test the significance of differences increase student mathematics self-efficacy between the received models

PBMK and who got the OT model for each category of PAM.

Based significance test indicates that the probability value (Sig.) Of all categories of PAM smaller $\alpha = 0,05$ so that H_0 is rejected. This means that the three categories of PAM, students who received PBMK models earned an average improvement of mathematics self-efficacy were significantly larger than students who received the OT model.

3. Data Analysis of Critical Thinking Ability of Mathematics and Mathematics Student Self-Efficacy Based Early Mathematics Knowledge

Based on the results of analysis of variance variable double two-way (Two-way MANOVA) showed that the value of Wilks' Lambda of treatment amounted to 0.280 greater than the value table $U_{2,1,2} = 0.0025$, or by looking at the value of $F = 61.579$ is greater than $F_{2,2} = 19.00$, or more simply by looking at the probability value (Sig.) of smaller treatment $\alpha = 0,05$ so that H_0 is rejected. This means that, there is the influence of problem-based learning model contextual and direct learning model to increase students' critical thinking skills of mathematics and mathematical self-efficacy of students based on prior knowledge of mathematics. The model used in the analysis of multiple variables two-way variance is:

$$Y_{ijk} = \mu_k + \tau_{ik} + \beta_{jk} + \varepsilon_{ijk} \quad \dots\dots\dots (1)$$

Based on the results of parameter estimation can be made of the equation or the estimated increase in critical thinking skills and self-efficacy mathematics mathematics students from equation (1), is as follows

$$Y_1 = 0,128 + 0,240 \tau_1 + 0,415 \beta_1 + 0,096 \beta_2 \quad \dots\dots\dots (2)$$

From the equation, it can give an estimate of the improvement of mathematics students' critical thinking skills (Y_1). Furthermore, estimates of the increase in self-efficacy mathematics (Y_2) are as follows:

$$Y_2 = 0,270 + 0,187 \tau_1 + 0,220 \beta_1 + 0,079 \beta_2 \quad \dots\dots\dots (3)$$

2. Discussion

The results of this study are consistent with results of previous studies that students who receive contextual learning model significantly gain increased critical thinking skills math higher than students who received conventional learning or learning directly, such as research Noer (2009), Somakim (2011), Syahbana (2012) and Wiliyati (2012). Something similar happens to students who receive contextual learning model significantly gain increased self-efficacy higher math than students who received conventional learning or learning directly, such as in research Somakim (2011) and Wiliyawati (2012).

If seen from the characteristics of problem-based learning model contextual, as previously described this condition might happen. Students who receive contextual problem-based learning cooperative learning through problem solving process contextual day-to-day student or contextual problem being simulated. In the process of solving these problems, students use all its potential to solve the given problem both independently and cooperatively to forward it to the class discussion. When students have problems in the process of solving the problem, they put a question to the teacher or the other students to clarify the issues and the various tasks assigned. At the same time, students are able to share, maintain, or value the opinions or ideas of solving the problem raised by other students. This activity can develop students' understanding of math problems given so as to facilitate them to solve the problem. This is demonstrated by the increasing critical thinking skills and self-efficacy mathematics mathematics students. This is in accordance with the opinion of Arends (2008: 43) that the problem-based learning can help students develop thinking skills, problem-solving skills as well as skills for independent learning and social skills.

Based on the initial knowledge factor mathematics student, was also a significant effect on the increase in critical thinking skills and self-efficacy mathematics mathematics students. The results of this study showed that the higher the students' prior knowledge, the higher the increase in critical thinking skills and mathematical self-efficacy is obtained by the students. In line with the results of research Somakim (2011) there are significant differences in terms of improving the critical thinking skills of mathematics based learning approach in terms of initial knowledge of mathematics students, but there are no significant differences in terms of increased self-efficacy based learning approach in terms of knowledge of early mathematics students. These results are in line with the opinion of Arends (2008: 268) that the initial ability of students to learn new ideas depend on prior knowledge of their previous and existing cognitive structures.

In general, it can be concluded that there are differences in problem based learning and contextual learning model directly to an increase in critical thinking skills and self-efficacy mathematics student mathematics overall and by category of initial knowledge of mathematics. This indicates that there are influences learning model to increase critical thinking skills and self-efficacy mathematical mathematics students. Based on the results of research and discussion, problem-based learning model contextual be better able to improve the critical thinking skills of mathematics and mathematics self-efficacy of students.

E. Conclusion

1. Improved critical thinking skills of students who got a mathematical problem based learning model contextual significantly better than students who received direct instructional model.
2. The average increase students' critical thinking skills of mathematics with PAM category (high, medium or low) that received contextual problem-based learning model is higher than the average increase in critical thinking skills of mathematics students with PAM category (high, medium or low) that gets direct instructional model.
3. Increased self-efficacy mathematics students who received problem-based learning model contextual significantly better than students who received direct instructional model.
4. The average increase in self-efficacy mathematics students with PAM category (high, medium or low) that received contextual problem-based learning model is higher than the average increase in self-efficacy mathematics students with PAM category (high,

medium or low) that gets direct instructional model.

5. There is the influence of contextual problem-based learning model and learning model directly to the improvement of students' critical thinking skills of mathematics and mathematical self-efficacy of students based on prior knowledge of mathematics. Problem based learning model contextual significant effect on the increase in critical thinking skills and mathematical mathematics self-efficacy of students based on prior knowledge of mathematics category.

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