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The Student's Errors in Mathematical Problem Solving Based on NEA Judging from the Self Efficacy on Learning CORE

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Abstrak

The purpose of this study were (1) to describe the quality of learning with models CORE of the errors made by students in solving mathematical problems and (2) to describe the students' errors in solving math problems by NEA in terms of self-efficacy categories of high, medium, low on the model of CORE. This study uses concurrent design *embeddes*. The population in this study was all students of class VIII SMP Negeri 1 Kalikajar, Wonosobo. Data collected through the data collection of quantitative and qualitative data collection. The results showed that (1) the quality of learning through CORE model of good category, and (2) the student category higher self-efficacy has a pattern of phase transformation and encoding errors. Student's category of self-efficacy was a pattern transformation phase error, process skills and encoding. Student self-efficacy lower category still make errors at this stage of reading, transformation, process skills, and encoding, but there is increased when writing down all the stages in detail.

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INTRODUCTION

The existence of mathematics in education and in life is very important. People use mathematics to solve problems in their daily life. Math help someone solve problems more effectively and efficiently. According to the NCTM (2000) the process of mathematical thinking in mathematics includes five main standard of competence include the ability to problem-solving, reasoning ability, the ability of connection, communication skills and the ability representation.

The curriculum in Indonesia also made it clear that the purpose of learning mathematics is supposed to achieve, namely (1) the ability of problem solving (problem solving); (2) The ability to argue (reasoning); (3) Ability to communicate (communication); (4) the ability to make a connection (connection); and (5) the ability of representation (representation). Interest submitted by the National Council of Teachers of Mathematics (NCTM) and a review of aspects of the curriculum mentioned that solving problems is one of the main pillars in the study of mathematics in the learning process.

As stated NCTM (2000), through problem solving students can use the benefit of mathematics. Students can learn and deepen their understanding of math concepts through solving problems. Learn about troubleshooting help students become familiar with a number of problem solving, such as looking for patterns, solve simple problems, until the problem is past.

In mathematics, problem solving abilities should be owned by the students to solve the problems based problem. While based on research that conducted by Nurqolbiah (2016), found poor ability of students' problem-solving. When students complete math problems, it would be very possible errors due to errors the students themselves. Reality on the ground indicates different error still do students in completing troubleshooting. Lack of problem solving skills resulted in many errors made by the student (Farida, 2015). There are also students who intentionally doing in origin because they lack motivation in mathematical problem-solving activities. In addition, students are less scrupulous, a factor that is insufficient time to work on the problems and haste in working on.

Such errors can be used as an indicator to determine how far the student's ability to master the material (Hidayat, 2013). This study aims to determine and identify the errors made by students in mathematical problem solving. By knowing the location and cause of errors students in problem solving, it will reduce errors made by the student (Junaedi, et al., 2015). Thus the students' mathematical problem solving errors can be minimized.

To find out where are the errors the students in solving their problem-solving need special methods. Methods Newman's Error Analysis (NEA) is a method designed as a simple diagnostic procedure that can help teachers to determine where errors do occur student. Thus, it is easy for teachers to be able to target effective teaching strategies to overcome them (Suyitno and Suyitno, 2015).

NEA also be used as a remedial strategy in the classroom by the teacher. The error analysis by the NEA has been helping students overcome difficulties and improve their problem solving skills (Kurniasih, 2015). Teachers, who develop NEA analysis based on a consistent basis, will be able to focus on teaching to increase a deeper understanding of the errors that waged students (White, 2004).

Handayani and Desi (2013) stated in his research that there is a relationship between self-efficacy and academic achievement of students. In lighter, Pajers and Miller (1994) stated that the Self Efficacy role in solving the problem. Based on some previous research that one of the factors that influence students' problem-solving ability is self-efficacy (Artha and Supriyadi, 2013; Kurniawati, 2014; Wiratmaja, et al, 2014; Sariningsih and Purwasih, 2017). There is a positive relationship between the problem solving and self-efficacy (Jatisunda, 2017). The

higher level of self-efficacy will be higher the students' problem-solving abilities (Jannah, 2013; Wahyuni, 2013; Iklima & Marzal, 2016; and Zubaidi, 2016).

Self-efficacy question is the confidence in students to solve mathematical problems that are being faced to obtain a solution. Self-efficacy that either will be able to increase self-confidence, so that in resolving the problems will automatically reduce some confusion in solving problems.

To minimize the errors made by students in solving mathematical problems, students need to be given training on the solution of the problem (Rahayuningsih & Qohar, 2014 and Siswandi, et al, 2016). In addition, we need a model of learning that can improve learning motivation and students' mathematical problem solving ability. CORE learning can be used as a method in teaching students. CORE is a learning model that expects students to be able to construct their own knowledge by connecting and organizing new knowledge with old knowledge and then think about the concept being studied. With the CORE model learning students are expected to improve mathematical problem solving ability and motivation during the learning process.

In this study, researchers wanted to know the type of error also students in solving a mathematical problem solving by NEA in terms of self-efficacy in learning model of CORE. Before analyzing students' errors in solving problem solving, researchers will see their lessons. Do learning using the CORE good? Furthermore, the test problem-solving, is to investigate and conduct an analysis of students' errors in solving troubleshooting. In this study will also be examined quality of learning using CORE models to increase students' ability in solving mathematical problem solving.

Based on the previous description, formulation of the problem of this study are as follows:The problems of this study are as follows: (1) How is the quality of learning with CORE models to students' mathematical problem solving ability ?; (2) How do errors students in mathematical problem solving by NEA in terms of self-efficacy of high category on the model CORE ?; (3) How do errors students in mathematical problem solving by NEA in terms of self-efficacy in the medium category CORE models ?; (4) How do errors students in mathematical problem solving by NEA in terms of self-efficacy lower categories on the model CORE?

METHODS

This study uses unbalanced mix designs (*concurrent embeddes*). Concurrent *embeddes* is a research method that incorporates a combination of qualitative and quantitative methods by mixing both methods are disproportionately. In concurrent *embeddes* both methods are used together, in the same time, but both are independent to answer the problem formulation similar (Sugiyono, 2016).

Subject research is class VIII SMP N 1 Kalikajar, Wonosobo. The research conducted at SMP N 1 Kalikajar, Wonosobo in class VIII with learning models *CORE* the material prism and pyramid. The research was selected in the second semester of the academic year 2016/2017.

The quality of learning is the success of the lesson activities and outputs produced (Uno, 2008). Hightower, et al. (2011) stated that quality learning is a series of activities that can improve student achievement of competence. To measure the success of learning, Danielson (2013) gives 4 domain to improve the learning quality. Four domains: (1) planning and preparation (planning and preparation), (2) classroom environment (classroom environment), (3) instruction (manual), and (4) professional responsibility (professional responsibility).

Errors in solving problem solving analyzed descriptively based document test results supported by interviews. The validity of the data is using triangulation techniques.

Qualitative data analysis includes data reduction, data presentation and conclusion.

Results and Discussion

Based on the analysis on self-efficacy questionnaire that has been previously validated by experts student groupings of data obtained in Table 1 below

Table 1. GroupingCategory Self-efficacy Grade VIII E

Category *self Efficacy*	Percentage	many Students
High	10.00	3
moderate	76.67	23
low	13.33	4
total	100	30

Here are the results of research quality of learning with CORE models implemented in class VIII SMP N 1 Kalikajar, Kab. Wonosobo. The planning stage of the assessment results of each validator learning device can be seen in table 2 below.

Table 2. Results Achievements Learning Tool Rating

Device	The Total Average	Category
Syllabus	4.00	Good
Lesson Plan	4.02	Good
Student Work Sheet	3.94	Good
Problem Solving Test	3.92	Good

The implementation phase of learning quality is said when the observation of the quality of teaching and learning minimal entered in both categories. Implementation of the learning is done 4 times. Results of the assessment of the quality of the CORE model study are presented in Table 3

Table 3. Observed Learning Quality

No.	Quality of learning	Average	Category
1	Meeting 1	3.040	Pretty good
2	meeting 2	3.080	Pretty good
3	meeting 3	3.730	Good
4	meetings 4	4.340	Very good
The average total		3.547	Good

Based on observations of the quality of teaching in Table 3 were obtained an average score of 3.547 so that it can be concluded that the category of quality learning model of CORE is good.

Phase evaluation using analysis of test results of mathematical problem solving ability of students. Before conducting the normality test data analysis of the data obtainedsignificant value= 0.200 = 20%> 5%. So accepted, meaning that the data came from a normal distributed population. Classical completeness of test results obtained value, testing criteria, and denied. Based on the normal list of raw obtained from the calculation, and is located in the region of rejection so accepted, meaning the percentage of students who completed the CORE model study of more than 75%. So the math problem solving ability of students in the learning model of CORE achieve mastery learning.$H_0 \alpha = 5\% \pi_0 = 0{,}75 H_0 z > z_{0{,}45} \alpha = 5\% Z_{tabel} = 1{,}65 z = 1{,}99 H_0 H_1$

From the calculation of the average difference obtained a value of 3.42 with degrees of freedom () = 58. 5% significance test obtained seen that or 4.75> 1.53. Thus rejected, which means that the average student mathematics problem solving ability experimental class is better than or equal to the average math problem solving ability control class $t_{tabel} = t_{(\,05{,}58)} = 1{,}53\ t_{hitung} > t_{tabel} H_0$

The gain calculation used to determine the increase in problem solving ability of students after being given a lesson using CORE.

Based on the results of the gain calculation classically known that an increase in students' problem-solving abilities. The results of gain in the classical calculation on problem solving ability of students can be seen in Table 4 below

Table 4. Results of the calculations Gain on Student Math Connections Capabilities

Petest	Portes	(g)	gain
41.63	66.63	$(g) = \frac{66.63 - 41.63}{85 - 41.63} = 0.58$	Mode-rate

Based on the calculations in Table 4.6 was obtained $(g) = 0{,}58$. This indicates that the value (g) in the range, $0{,}3 \leq (g) < 0{,}7$, so the category of the normalized gain medium category. The conclusion is that the problem solving ability of students with learning CORE experimental class increased by the moderate category.$(g) = 0{,}58(g)0.3 \leq (g) < 0{,}7$

The results of the data analysis and interviews problem solving test research show that math solving skills which each student is different, depending on category*Self-efficacy*students. This is in accordance with the opinion of Pimta, et al. (2009) which states that the indirect factors affecting the students' problem-solving ability is motivation (motivation) and confidence (self-efficacy). Self-efficacy that either will be able to increase self-confidence, so that in resolving the problems will automatically reduce some errors in solving problems.

Type error in solving problem solving in students with high self-efficacy category includes errors in reading stage, transformation, process skills, and encoding. The results were obtained information that indicates that students with higher self-efficacy categories did a little mistake on problem solving test. The pattern of errors students with high self-efficacy categories in more detail contained in Table 5 below.

Table 5. Pattern Self Errors Students with High Efficacy

Error type	Initial tests	Final test	Decrease Errors
Reading	60.00%	13,30%	46.67%
comprehension	70.00%	0%	70.00%
Transformation	27.80%	4.17%	23.63%
Process Skills	35.30%	7.84%	27.46%
encoding	93.34%	66.70%	26.64%

From the table, the error pattern can be explained in greater detail about the error patterns of students with high self-efficacy as follows.

On stage *reading* students are able to write information known to the questions that have been read and capable of changing variables that are known in question into mathematical symbols and language. Only 13,30% contained errors made by students at the end of the test. A decrease of 46,67% compared to before the treatment. Errors on stage reading were done by a student on the grounds not used to write this stage. But basically all students with high self-efficacy categories have understood this stage.

In Phase Comprehension students with category High *self-efficacy* does not make errors. Of the five problem solving is given, all written what is being asked in the matter clearly and in detail. There is a decrease in error as much as 70% after the learning. This means there is one mistake made by students with High Efficacy Self at this stage. The third stage is transformation, mamput Students choose the appropriate resolution procedures and can make

a mathematical model that will be used to solve the problem in question. 4,17%, there are still errors made at this stage. But already decreased 23,63% compared to prior learning. In the process skills of students are able to use the settlement procedure chosen correctly (to complete the operation count correctly). Errors that students do in this stage is as much as 7,84% at the end of the test after the lesson. The last stage of encoding, students are able to determine and present the final answer correctly but does not perform the examination results and sometimes not write the conclusion. Errors that tend much to do at this stage. Evidently there are 66,70% of students with high self-efficacy wrongdoing.

Type the errors made by the students in solving the problem solving category includes self-efficacy was a mistake at this stage of reading, comprehension, transformation, process skills, and encoding. Based on the students' errors NEA pattern in terms of Self Efficacy category were as follows.

Table 6. Patterns Error Students with Self Efficacy Medium

Error type	Initial tests	Final test	Decrease Errors
Reading	77,00%	22,20%	54,80%
comprehension	64,80%	4,35%	60,27%
Transformation	26,30%	9,96%	16,34%
Process Skills	45,80%	19,70%	26,10%
encoding	97,39%	77,40%	19,99%

The results were obtained information indicating that the student with the category of self-efficacy were still made some errors in the following problem solving test.

Errors at this stage of reading and comprehension because students do not write. What is known and what is asked in a systematic matter. The reason given by students at the time of the interview is that there used to write down what is known in detail. At this stage of reading, there are some students who just wrote some of information on the matter, even with only describe the problem without providing answers. Errors at this stage of transformation carried out by the students because there is a settlement procedure that is not complete even after can choose the appropriate resolution procedures. However, a decrease in error is 26,30% on the initial test be 9,96% at the end of the test after performing on learning stage. Therefore process skills, errors made is operating errors in the calculation process to solve the problem using the selected procedure. Errors on Initial tests by 45,80% to 19,70% at the end of the test. While at the encoding stage, student is able to determine and present the final answer correctly but does not perform the examination results and sometimes not write the conclusion. However, a decrease in errors between the initial test and final test is 19,99%.

Type the errors made by the students in solving problem solving with low self-efficacy categories: stage reading, comprehension, transformation, process skills, and encoding. The results showed that students with low self-efficacy categories are still having trouble completing most of the problems of mathematical problem solving. This means that students with low self-efficacy category still make many errors on problem solving test. The pattern of errors is more detail contained in Table 7 below.

Table 7. Errors Students Pattern with Self Efficacy Medium

Error type	Initial tests	Final test	Decrease Errors
Reading	80,00%	40,00%	40,00%
comprehension	80,00%	10,00%	70,00%
Transformation	49,00%	26,00%	23,00%
Process Skills	64,70%	36,00%	28,70%
encoding	95,00%	95,00%	0%

Here is a category error patterns of students with low self-efficacy.

Students can not write invormasi known in a matter that has been read and can not

change that unknown variable in question into mathematical symbols and language. However, there is a decrease of error of 40,00% from the initial tests. At this stage of comprehension, students still feel confused and unable to write as well as define the variables in question in the matter. After learning, the error decreases at the initial test be 10,00% to 80,00% at the end of the test. This means that there is a decrease of 70,00%. Errors at this stage of transformation carried out by the students because there are erroneous settlement procedure, so the effect on the next stage. This is because students cannot choose the proper resolution procedure (cannot create a mathematical model that will be used to solve problems in the matter). There is a decrease in error from the initial tests of 49,00% to 26,00% at the end of the test. While at this stage of process skills, errors made is operating errors in the calculation process to solve the problem using the selected procedure However, students with low self-efficacy after learning progress. It can be seen there is a 28,70% decrease. In preliminary tests the error committed was 64,70% to 36,00% at the end of the test. At the encoding stage, the errors made are not written conclusions from the answers that have been done correctly Students are not able to determine and present the final answer properly so it cannot perform the examination results and conclusions. Errors made by students with low self-efficacy are still the same. This means that there is no increase of the initial test and final test.

CONCLUSION

Based on the analysis and discussion be concluded as follows: (1) The quality of the CORE model study on the ability of mathematical problem solving eighth grade students in both categories at the three stages of the planning, implementation and evaluation;(2) Students category of high self-efficacy has a pattern of phase transformation and encoding errors that incorrectly use the settlement procedure and does not conclude the results; (3) The pattern of errors made by the students' self-efficacy moderate category is at the stage of transformation, process skills and encoding; (4) The student self-efficacy lower category still make errors at this stage of reading, transformation, process skills, and encoding, but there is increased when writing down all the stages in detail. (5) The errors committed by the subject by a thirdcategory self-efficacy (high, medium, low) is the lack of familiarity carefully situations and solve problems solving problems based on the existing procedures in the NEA.

SUGGESTION

Based on the discussion and the discussion of the results obtained, some advice that can be given is as follows: (1) Errors made by students in solve the problem is very diverse. NEA as a diagnostic procedure can be used to help locate the fault of students in solving the problems; (2) the diversity of the category from self-efficacy by students who have not been known to cause difficulty in mapping the treatment of each student. Knowing the diversity of categories from self-efficacy is a good way can be used to provide an overview of treatment for each student. Student with the category of self-efficacy height needs to be given spirit to develop mathematics problem-solving skills. Students with the category of self-efficacy are in need of guidance in order to resolve the problem solving and reduce errors caused by lack of accuracy. While students with low self-efficacy category should be given more motivation at every stages in the process of problem solving so that students with low self-efficacy category can reduce the error rate in solving problem solving; (3) The use of the learning model in this study rated CORE qualified and enhance problem-solving abilities, there by reduce errors of students in solving mathematical problem. Therefore, CORE models can be selected in the learning which aims to reduce errors of students in solving problems.

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