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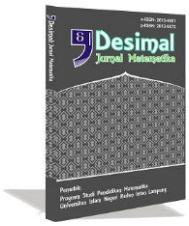

How Mathematical Reasoning Abilities can be improved? : A Study Case at Islamic Boarding School

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ABSTRACT

The development of mathematical reasoning ability of students affect the process of settlement of problems exiting in the process of learning mathematics. This study has the objective to determine the learning model that is effective between the Problem Based Learning models and the Learning Cycle 5E models. This study using quantitative study, data analysis techniques using T-test. The study results obtained it can be concluded that, mathematical reasoning ability of students has increased more effectively when the learning process apply the Problem Based Learning models.

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INTRODUCTION

Mathematics learning has always been a problem in itself for students at various levels. Reasoning for existing material is one of the various causes of the problem. Especially when students are faced with questions that require a high ability to reason to be able to determine the completion that must be taken. The introduction of reasoning ability to students as early as possible, will enable students to feel helped to understand the learning that is taking place and allow students to increase their confidence while reducing the level of fear of students in solving existing problems (Pitriati, 2019). Based on previous research, research has been conducted that discusses students' reasoning abilities, by pairing them with several learning models such as the Student Question Have model, Advance Organizer, Numbered Heads Together (Burais, Ikhsan, & Duskri, 2016; Sulianto, Sunardi, Anitah, & Gunarhadi, 2019; Yenni & Aji, 2016). Judging from

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previous studies students' mathematical reasoning ability becomes an interesting topic to be reviewed.

The 5E learning cycle model is one of the many learning models that creates opportunities for students to actively participate in the learning process. Where it can improve students' mathematical reasoning abilities. Stages in the Learning Cycle model, students are guided to be able to find and discover new knowledge by themselves (Asmawati & Wuryanto, 2014). Based on previous research there are studies that use the Learning Cycle 5E learning model to affect the ability to understand mathematical concepts, to learning outcomes, to the ability to solve mathematical problems (Asmawati & Wuryanto, 2014; Pratiwi, 2016; Sulastri, Mariani, & Mashuri, 2015).

There are several learning models besides the 5E learning cycle model that might be used to improve students' reasoning abilities, one of them is the Problem Based Learning (PBL) learning model. The learning process in the learning model Problem Based Learning students are made face to face with a problem so as to develop the ability to reason students and students can by skillfully complete (Lestari & Yudhanegara, 2015). Based on previous research, research has been carried out using the Problem Based Learning learning model affecting problem solving, students' critical thinking abilities, and student learning outcomes (Gunantara, Suarjana, & nanci Ristini, 2014; Nurkhasanah, Wahyudi, & Indarini, 2011; Situmorang & Samosir, 2018).

Previous research also conducted research using the Learning Cycle and Problem Based Learning models of students' reasoning abilities (Permana & Sumarmo, 2007; Pitriati, 2019). In terms of previous research, no one has explained the learning model which is more effective if it is used to develop students' reasoning ability between the two learning models (Kasayanond, Umam, & Jermsittiparsert, 2019). So the purpose of this article is to look at the learning model between the Learning Cycle 5E learning model and the Problem Based Learning learning model which is more effective if used to develop students' mathematical reasoning abilities.

METHOD

This research is a quantitative study, using the learning cycle learning model 5E and the problem based learning (PBL) learning model. Following the flow of research methods carried out.

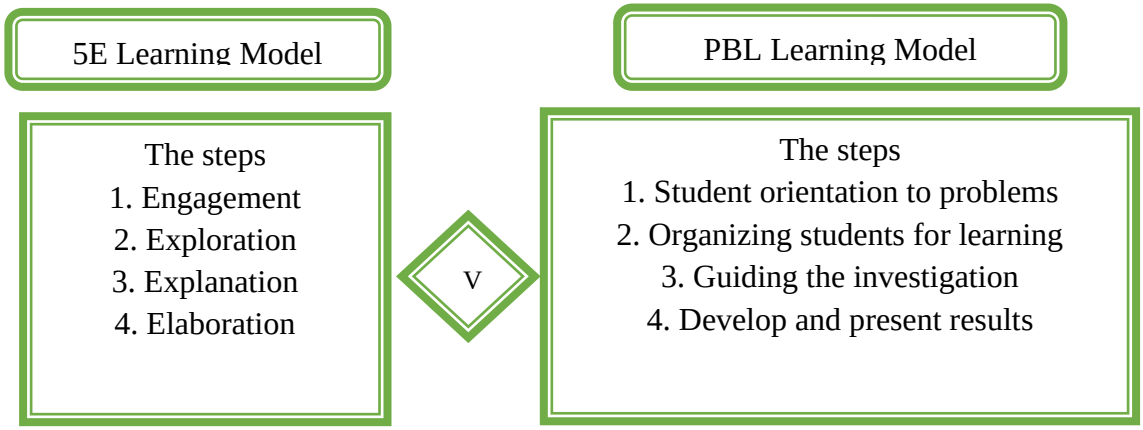

Figure 1. Research Design

Based on Figure 1. The study applied learning by using two learning models namely the 5E model and the PBL model. The steps of the 5E learning model include

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engagement, exploration, explanation, elaboration, and evaluation. The steps of the PBL learning model include student orientation to the problem, organizing students to learn, guiding individual and group investigations, developing and producing work, and analyzing and evaluating. Data collection in this study used a pretest and posttest test. This research was conducted to see learning models between 5E learning models and PBL learning models that are more effective in improving mathematical reasoning abilities. The data analysis technique used is the T Test.

RESULTS AND DISCUSSION

Based on the results of research that discusses the improvement of students' mathematical reasoning abilities obtained from the pretest and posttest of the experimental class applying the Problem Based Learning learning model and the experimental class applying the 5E Learning Cycle learning model in order to obtain the following research results.

Table 1. descriptive data between the 5E learning cycle model and the Problem Based Learning (PBL) model

	Mean	median	Varians	Std. varians	Min	Max
Model 5E	57,77	54,50	481,261	21.938	13	100
Model PBL	68,77	66,67	191,897	13,835	43	100

Based on Table 1, descriptive data between the 5E learning cycle learning model and the Problem Based Learning (PBL) learning model shows that the average value of the Problem Based Learning (PBL) model is better than the 5E learning cycle model. Also seen the minimum value in the Problem Based Learning PBL model is also better than the 5E learning cycle model. This results in that the PBL Problem Based Learning model is better than the 5E learning cycle model in improving mathematical reasoning ability. Furthermore, it will be seen more clearly in Table 2, namely the independent sample test table.

Table 2. Independent sample test

		Levene's Test for equality of variances		t-test for equality of means		
		F	sig	t	Df	Sig(2-tailed)
N-Gain	equal variances assumed	6,654	.012	-3,149	68	.001
	equal variances not assumed		.012	-3,149	57,395	.001

Based on Table 2 the independent sample test can be seen that:

Hypothesis testing

$H_0 : \mu_1 \geq \mu_2$

$H_1 : \mu_1 < \mu_2$

μ_1 = Average learning model learning cycle 5E

μ_2 = Average Problem Based Learning (PBL) learning model

Based on Table 2 it appears that the P-value < 0,05, so H_0 the hypothesis test was rejected. This means that it can be concluded that the Problem Based Learning (PBL) learning model is more effective in improving mathematical reasoning ability than the 5E learning cycle learning model.

Learning model Learning Cycle 5E becomes one of the learning models with constructivist approaches. This opinion was seen in the process of applying the Learning Cycle 5E learning model that

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contained five stages. The five stages are engagement, exploration, explanation, elaboration, and evaluation (Asmawati & Wuryanto, 2014). Stages of engagement is a process of brief introduction to students about the material that will be discussed in the learning process. Exploration is the process by which students are given the opportunity to test, do and record what they observe related to the subject matter. Explanation is the process by which students are given the opportunity to present the results of an experiment using their own language. Elaboration is a time when students apply the concepts they have acquired in other situations. Finally, the evaluation stage where students will be asked their understanding of the material discussed in the learning process (Pratiwi, 2016).

The advantage of implementing the 5E Learning Cycle learning model in the learning process according to Soebagio is that this learning model is student centered, new information given to students will be linked to knowledge that has been obtained before (Munifah, Huda, et al., 2019), the learning process is oriented towards investigation and new discoveries to solve problems, use real experience makes the learning process more meaningful, makes students do not rely on traditional ways of learning that are more memorizing, students will become more active, critical and creative (Asmawati & Wuryanto, 2014).

Problem Based Learning learning model is a learning model that first provides a presentation of a problem that has been designed, where the context is relevant to the material to be discussed in the learning process. The process will give students knowledge and understanding of concepts, be able to think more critically, be able to build independence in learning, increase collaboration in group work processes, and problem solving will be further increased (Permana & Sumarmo, 2007).

The steps taken in the learning process that apply the Problem Based Learning learning model begins with the teacher directing students to be oriented to the existing problems. The second step is the teacher forms groups for students to learn in stages with the existing problems. The third step the teacher guides the discussion process that is in the group. The fourth step students are asked to develop the results obtained from group discussions and present them. The final step where the teacher and students do an analysis of the results presented and evaluate the results obtained (Sulastri et al., 2015).

Based on the explanation, it can be seen that the Problem Based Learning model is more effective in improving students' mathematical reasoning abilities compared to the Learning Cycle 5E learning model. This can be seen from the different stages that are applied to each learning model (Munifah, Romadhona, et al., 2019). The difference can be seen from the steps in the Problem Based Learning model applying independent learning students but the teacher still contributes to guide in each process such as the teacher divides the discussion group but still guides directly. Contrary to the learning process that is applied in the Learning Cycle 5E learning model that emphasizes students processing independently and the teacher does not directly guide it.

Seeing the results of previous studies, that the Problem Based Learning model of learning can affect the ability of critical thinking, problem solving, and student learning outcomes (Gunantara et al., 2014; Nurkhasanah et al., 2011; Situmorang & Samosir, 2018). Learning Cycle 5E learning model on the results of previous research can also affect the ability to understand mathematical concepts, mathematical problem solving abilities and student learning outcomes (Asmawati & Wuryanto, 2014; Pratiwi,

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2016; Sulastri et al., 2015). Both of these learning models when used to find out which model is more effective to improve students' mathematical reasoning abilities will be more effective if the Problem Based Learning learning model is applied in the learning process (Munifah, Tsani, et al., 2019).

CONCLUSIONS AND SUGGESTIONS

Based on the research, there is a difference between the application of the Problem Based Learning learning model and the Learning Cycle 5E learning model. It was concluded that the Problem Based Learning model gave a more effective impact on improving students' mathematical reasoning abilities compared to the Learning Cycle 5E learning model.

Suggestions for future research might be possible to do research with other learning models that might have a more effective impact on improving students' mathematical reasoning abilities. This will help in solving some of the problems that are often faced by students when the mathematics learning process is ongoing.

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