



Students' Creative Thinking Abilities and Self Regulated Learning on Project-Based Learning with LMS Moodle

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Abstract

The purpose of this study is to examine the effectiveness of project-based learning with LMS Moodle towards the students' achievement of creative thinking abilities and self regulated learning, and describe how to students' achievement of creative thinking abilities and self regulated learning. This study uses mixed methods research with concurrent embedded designs. The population in this study were students of senior high school class X at Putra Nirmala Cirebon of 2017/2018 academic year. Data collection techniques used in this study are observation, tests, and interviews. The research subjects were taken based on students' early mathematical abilities categories, namely above, middle and bottom categories. The findings showed that project-based learning with LMS Moodle was effective to the students' achievement of creative thinking abilities and self regulated learning. Overall, the students' achievement of creative thinking abilities and self regulated learning who using project-based learning with LMS Moodle is better than students who using conventional learning. As for contribution (Effect Size) project-based learning with LMS Moodle towards the students' achievement of creative thinking abilities which are equal to 0.85 while self regulated learning is 0.95. The category of achievement of creative thinking ability and self regulated learning are included in the high category.

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INTRODUCTION

The development of science and technology has taken change almost all the human's aspects of life where the problems only can be solved except by efforts of mastery and improvement of science and technology. Mathematics has a very important role in mastering science and technology. Along with the rapid development of science and technology, everyone is required to have good communication skills, able to think critically, systematically and creatively. Mathematics is a skill that must be possessed by students, so that they are able to face up the mathematical problems in particular, and the daily life problems in general (Sapto, 2015; Indrawati & Hartati, 2017; Saputri, 2016).

According to Permendikbud no. 59 of 2014, mathematics subjects need to be given to all students starting from elementary and secondary schools to equip students with the ability to think logically, analytically, systematically, critically and creatively, as well as the ability to work together. One of the main goals of mathematics learning is to habituate students to think creatively, namely the ability to construct or produce new ideas or ways to solve mathematical problems (Konita, 2017). The creative thinking ability is the students' abilities to understand problems and find solutions with varied strategies or methods (Siswono, 2005). Creative thinking is needed for someone because this is basis to respond and find solutions to the problems they face. Considering that the problems they faced may not be resolved in a way that has existed before, but it requires a new combination both in the form of attitudes, ideas, and mind products, so that the problem can be resolved (Trisnawati, 2018; Asmarawati & Suparman, 2018).

However, based on the results of observations and interviews to the mathematics teacher of SMA Putra Nirmala Cirebon, mathematics learning still does not lead to increase in mathematical creative thinking ability. Students are poorly trained in doing questions that can sharpen creative thinking, so students' mathematical creative thinking abilities are still low. This is in line with research of (Rahmazatullaili, 2017; Siswoyuno & Susilo, 2016; Sari, 2017; Tasni & Susanti, 2017) said that mathematics learning by teachers in schools is still not paying attention to creative thinking ability and

problem solving. In the learning process, students are used to solve problems that only require them to think convergently, so that they are not used to face up with problems that require them to think broadly.

Another problem that appear is the lack of variation using models/methods in learning, especially computer learning models. The teacher still does not fully utilize the advantages of technology in learning mathematics, even though technological development is so rapid. Teaching and learning process are less innovative, still using the conventional method, so that the lack of students' motivation to learn mathematics. Conventional learning used in schools is one of the factors causing low of students' creative thinking abilities (Ramadhani, 2015; Atikasari & Kurniasih, 2015; Subekti, 2012, Saparwadi, 2014). This time learning is still dominated by the "teacher centered" paradigm where learning activities are still centered on the teacher that making students' self regulated learning become low (Lestari, 2015; Yenni & Putri, 2017)

Hamalik (2004: 171) states that effective learning is learning that provides opportunities for students to learn independently, so that by doing learning activities, students are able to gain knowledge from their own understanding. By self regulated learning, students are required to have activeness and initiative in learning, students believe in their own abilities. Puteh & Ibrahim (2010) said that students who have a good self-learning strategy get good test results in doing problem solving skills compared to students who do not have a strategy. Students are able to apply appropriate skills in solving problems.

Based on the description above about the importance of creative thinking ability and self regulated learning, needed learning model that can involve students fully in the learning process and encourage students to be able to construct their own knowledge. One learning model that can encourage students to develop creativity and foster self regulated learning is using Project-Based Learning (PjBL) with LMS Moodle. PjBL model is a learning model that uses projects/activities as media. Project-based learning provides opportunities for students to explore content (material) by using various ways that are meaningful to themselves, and conduct

collaborative experiments (Ainurrizqiyah, 2015; Daniel, 2016; Amanda, 2014; Hartini, 2017).

By combining learning using LMS Moodle, the teacher can manage material, namely compiling syllabus, uploading material, giving assignments to students, accepting the work of students, making tests/quizzes, giving values, monitoring activeness, managing values, interacting with students through discussion forum and chat (Surjono, 2013: 6). On the other hand, students can access information and materials, interact with teachers and other students, work on tests/quizzes, see achievement of learning outcomes, and others, so students can access them before learning takes place. This is intended in order to students have prepared themselves before learning takes place, so that learning can be more optimal (Dewi & Kusumah, 2017)

In line with Fitriana's research (2016) concluded that the PjBL learning model was able to improve students' mathematical creative thinking abilities if compared to students who obtained conventional learning based on overall students, while Yusuf (2016) in his study said that learning using e-learning Moodle can help teachers in learning, students can do the learning process without being limited by space and time, so students can study whenever and wherever. Romdhani (2016) said that using Moodle can help teachers and lecturers apply learning and make it easier to evaluate students' learning outcomes, by clicking the value, the teacher, lecturer and students immediately find out the test scores that they just took.

Based on the background, this study focused on the achievement of creative thinking ability and self regulated learning through the PjBL model with LMS Moodle.

METHODS

This study uses a research combination of qualitative and quantitative (mixed methods). Data collection is done with concurrent embedded strategy, namely a research strategy that combines the use of quantitative and qualitative research together, but the weight of the method is different (Creswell, 2014). In this study, quantitative research is the primary method, while qualitative research is a secondary method. The qualitative research as supporting data

to analyze students' creative thinking abilities. This research begins with the collection and processing of quantitative data and ends with the collection of qualitative data.

The design of this study uses experimental and control classes. This study requires experimental and control class and only does a post-test. The treatment is only given to the experiment class, namely using project-based learning with LMS Moodle. The research design is

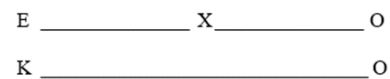


Figure 1 Research design (Creswell, 2016)

Note :

E : Experiment class

K : Control class

X : Treatment PjBL learning with LMS Moodle

O : Doing creative thinking ability test and self regulated learning questionnaire

This research consists of two stages, namely the pre-field stage and the field work stage. At the pre-field stage, the researcher arranges the research design, selects the research place, takes care of licensing, conducts initial observations, prepares research equipment including syllabus, lesson plans, teaching materials, worksheets, and tests of creative thinking ability. The compiled equipment is validated first by an expert validator.

In the field work stage, it starts from selecting a sample consisting of 1 experimental and 1 control classes based on random sampling technique, namely the experimental class using the PjBL model with LMS Moodle, while the control class using conventional learning. Next, the researcher conducted four mathematical course with material of sine and cosine rules in the experimental class, using the PjBL model with LMS Moodle.

RESULT AND DISCUSSION

Early Mathematical Ability (KAM)

The data of early mathematics ability is data used to describe the students' early creative thinking abilities towards the materials used as prerequisites of trigonometry, namely about the triangles in the previous material. The results of this early mathematical ability test are used as a basis for

grouping students according to their abilities, namely students with upper, middle and lower abilities. Data of early mathematical ability is presented in the following table

Tabel 1. Data on Students' Early Mathematical Abilities in Experimental and Control Classes

KAM CATEGORY	STAT	PM		KV	
		KAM	<i>n</i>	KAM	<i>n</i>
Upper	\bar{x}	89.1	8	87.0	6
	<i>s</i>	10.7		10.8	
Middle	\bar{x}	75.1	19	75.9	19
	<i>s</i>	12.2		11,3	
Bottom	\bar{x}	62	6	66.3	7
	<i>s</i>	5.5		3.2	
Total	\bar{x}	76.2	33	75.9	32
	<i>s</i>	88.6		53.7	

Note :

KAM : Early Mathematical Ability

PM : PjBL Learning with LMS Moodle

KV : Conventional Learning

Based on Table 1, it can be seen that overall the average value of students' early mathematical abilities in the experimental class is 76,2 while the average value of students' early abilities in the control class is 75,9. Furthermore, it will be tested the average similarity of the early mathematical ability in the two classes. This aims to determine whether the two classes have the same initial conditions. Because the data are normally distributed and homogeneous,

then the average similarity test by using parametric statistics. Based on the average similarity test is obtained that the students' average of early mathematical abilities in the experimental class is the same as the students' average in the control class. Thus both the experimental and the control class have similarity in the initial abilities.

Furthermore, based on the early mathematical ability tests that obtained by students divided into several categories, namely upper, middle and lower abilities. The results of grouping in the PjBL model with LMS Moodle based on Table 1, namely the category of upper group, there are 8 students, the middle group category is 19 students and the lower group category is 6 students, while the upper group category in the conventional learning, there are 6 students, the middle group category has 19 students and the lower group category there are 7 students.

Students' Creative Thinking Abilities (KBK)

Based on the results, it was found that overall students' achievement of mathematical creative thinking abilities who using PjBL learning with LMS Moodle was better than students who using conventional learning. The category of students' achievement of mathematical creative thinking abilities who using PjBL with Moodle LMS is high category, while students who using conventional learning are moderate. As for contribution (effect size) of the PjBL model with LMS Moodle on the achievement of creative thinking ability is presented in the following Table 2

Tabel 2. The contribution of learning model to the achievement of creative thinking ability (KBK)

DATA	KAM CATEGORY	STAT	PM		KV		ES	Category
			Post-tes	<i>n</i>	Post-tes	<i>n</i>		
KBK	Upper	\bar{x}	83.2	8	77.1	6	0.81	High
		<i>s</i>	52.8		84.6			
	Middle	\bar{x}	77.5	19	73.5	19	0.52	Medium
		<i>s</i>	61.4		60.1			
	Bottom	\bar{x}	76	6	57.1	7	2.34	High
		<i>s</i>	131.5		31.6			
	Total	\bar{x}	78.7	33	70.7	32	0.85	High
		<i>s</i>	73.9		108.9			

Note :

PM : PjBL Learning with LMS Moodle

KV : Conventional Learning

KBK : Creative Thinking Ability

ES : Contribution (Effect Size)

Based on Table 2, it can be seen that the contribution (Effect Size) of PjBL learning with LMS Moodle towards the achievement of creative thinking ability is included in the high category. The contribution if viewed from upper to lower groups on the early mathematical ability is successively included in the high, medium and high categories. This is because in the PjBL learning with LMS Moodle, students are able to formulate their own learning goals and organize their own learning activities, thus helping students to build their own knowledge based on experience and interaction between members of their groups. The results of this study are in line with the findings (Yunianta, 2012; Maysarah, 2017; Rahmatudin, 2016) said that PjBL learning effectively improves the students' mathematical creative thinking abilities. PjBL learning is able to give significant influence on students' creativity (Noviyana, 2017; Ardianti, 2017; Ismayani, 2016). Jussoft et al. (2010) said that the PjBL learning habituates students to be more disciplined and systematic in solving problems. Students are required

to produce a project where the project requires creativity from the knowledge they have, by collaborating with group members, so that it motivates students to solve problems or assignments given. Thus, this model directly requires students' creativity in solving the problems received.

Students' Self Regulated Learning

Based on the results of the study it was found that overall students' achievement of self regulated learning who using PjBL learning with LMS Moodle was better than students who using conventional learning. Students who using PjBL learning with LMS Moodle seemed more independent both in doing assignments and in the learning process. This shows that PjBL learning with LMS Moodle gives a high contribution to the students' achievement of independence in learning. As for the effect size of the PjBL model with LMS Moodle towards the achievement of self regulated learning is presented in table 3 below

Table 3. The contributions of learning (ES) to the achievement of self regulated learning (KB)

DATA	KAM CATEGORY	STAT	PM		KV		ES	Category
			Post-tes	<i>n</i>	Post-tes	<i>n</i>		
KB	Upper	\bar{x} s	78.4 13.1	8	75.8 5.0	6	0.88	High
	Middle	\bar{x} s	71.6 22.7	19	64.9 24.3	19	1.43	High
	Bottom	\bar{x} s	69 22.4	6	67.6 3.6	7	0.45	Low
	Total	\bar{x} s	72.8 30.4	33	67.5 33.2	32	0.95	High

Note :

PM : PjBL Learning with LMS Moodle

KV : Conventional Learning

KB : Self Regulated Learning

ES : Contribution (Effect Size)

Based on Table 3, it can be seen that the contribution (Effect Size) of PjBL learning with LMS Moodle towards the achievement of self regulated learning overall including in the high category. If viewed based on the students' early mathematical abilities, the contribution of the PjBL with LMS Moodle in the upper and middle groups is included in

the high category, but the contribution of the PjBL with LMS Moodle in the lower group is still low, which means that the learning model has not been able improve students' self regulated learning in the lower of the early mathematical ability group. This is because many factors that influence one of them, namely students with lower mathematical early abilities, are still unfamiliar with learning models that

focus on "student center", so it takes a long time to improve their self regulated learning, but overall achievement of self regulated learning is included in high category.

The results of this study are in line with the findings (Puspasari, 2017; Isnaniah, 2017; Febriastuti, 2013) said that the application of the PjBL learning is able to improve students' self regulated learning, while research (Muazizah, 2016) said that students using e-learning based Moodle get results achievements and self regulated learning are higher if compared to conventional classes. The results of other studies said virtual class based on e-learning Moodle is able to improve students' self regulated learning (Amandu et all, 2013; Maghfiroh, 2017; Núñez et all, 2011; Sudiana, 2017).

CONCLUSION

Based on the results of this study, it was concluded that the students' achievement of creative thinking ability and self regulated learning in PjBL with LMS Moodle is better than students' abilities in conventional learning. There are differences in the students' achievement of creative thinking ability and self regulated learning between classes that using the PjBL learning with LMS Moodle with conventional learning. As for the contribution (Effect Size) of PjBL learning with LMS Moodle on the students' achievement of creative thinking abilities and self regulated learning included in the high category.

The results of the study can be used as a reference to conduct further research on the use of certain learning strategies that can be used to measure the students' creative thinking abilities and self regulated learning. Project-based learning with LMS Moodle can be used as an alternative learning model for teachers to be applied in the classroom in order to improve students' creative thinking abilities and self regulated learning.

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