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The effect of portfolio-based learning models and self-regulated learning on student's creative thinking skills on acid and base materials

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Abstract
The acid and base concepts are fundamental in understanding chemistry taught at senior high schools. The chemistry concepts are generally abstract and sometimes complex. Teachers are required find ways that lead to improve their students understanding. This study aimed to look at the effect of portfolio-based learning model and self regulated learning on students creative thinking skills on acid and base teaching materials. Data of students creative thinking skills were collected with test and self-regulated learning with questionnaire. The data analysed with two-way ANOVA shows that the portfolio-based learning models and students self-regulated learning have a positive effect on the students' creative thinking skills in the material taught. However, both are independent and do not interact each others in affecting the student creative thinking skills.

Keywords: Acid and base, Creative thinking skills, Portfolio based learning model, Self regulated learning

1. Introduction

The toughest challenge in Indonesian education today is how to improve student achievements as required by the nasional standard of education. Teachers directly interact with the students in classroom teaching are responsible to deliver quality of learning to their respective students to ensure quality graduates who have competitiveness and adaptive on ravid changes of education and creative in solving

problems they face. The success of learning activities depends a lot on the process that takes place effectively and student activities (Herlina et al. 2019). Learning achievement can be improved when students are able to explore the knowledge and experience during the learning process in the classroom or the surrounding environment. The success of the learning process can be seen one of them from student learning outcomes (Silaban, 2017; Sinaga & Silaban, 2020). The teacher's job is to create opportunities for students to develop and improve critical and creative thinking skills so they are able to understand the world around them and make good decisions, improve performance, and increase learning motivation (Stobaugh, 2013).

The creative thinking skills is an important ability for students to have so that students can solve problems encountered in a constantly changing world. Creative thinking is a mental activity to increase purity (originality) and sharpness of understanding (insight) in developing something (generating) (Coleman & Morris, 2011). Thus, the development of the ability to think creatively is an important thing to do and needs to be trained for students ranging from basic education to secondary education. In line with in journal that creative thinking is an important component that determines the superiority of a nation, the progress of a nation is no longer determined by how much resources the nation has, but is determined by how creative existing communities in the nation (Rudibyani, 2019).

Then in the learning process needed an skills in students to plan their learning so that students can manage their learning time well. The skills that can be used is self regulated learning. Self regulated learning is the skills of students to set achievement strategies, set targets, and think about everything related to achieving desired goals and ultimately be able to evaluate their success in learning so as to cause them to have a strong urge to learn and actively participate in learning (Ahmar, 2016). By implementing self-regulated learning it can support students in monitoring the learning process. Students can find out ways of learning that can be used to obtain information (Manganello et al. 2019). Teachers therefore need to find an innovative learning model which will be able to generate student activity to enrich the learning experience, make the community a source of learning, and facilitate students to interact with their environment.

Portfolio-based learning model facilitates directly engagement of the students with existing problems in this case acid-base teaching materials, thereby minimizing boredom and abstractness of the material learned so far in theory and at the same time proving real problems with the theory being studied. Several studies relate portfolio-based learning model and creative thinking skill of student in developing certain competences. The model is able to facilitate almost the overall skills of students such as knowledge, making prediction from limited information, finding problems, developing hypotheses, testing hypotheses, and looking at information from different points of view (Tawil & Suryansari, 2012; Amin, 2013).

Preliminary study conducted at SMAN 15 Tanjung Jabung Barat Jambi Province, it can be seen the problems faced in the learning processes conducted. Teaching materials are not yet linking with chemical products found in daily life, the use of chemicals. The learning is only focused on explanation theoretically. This study aimed to look at the effect of portfolio based learning models and self regulated learning on students creative thinking skills in studying acid and base teaching materials.

2. Methods

This experimental research study a 2x2 factorial design experiment is use with control group posttest only design. Two classes of students assigned randomly were given posttest to collect the data of students creative thinking skills. Individuals in each group taken as such do exist and are willing to be the subject of research (Zuriah, 2009).

This study was conducted at SMAN 15 Tanjung Jabung Barat at even semester of the 2019/2020 school year. The test instrument design to gather data of student creative thinking skills was administrated after the treatment. On the other hand, the data of the student self regulated learning was administrared before the treatment. The experiment class was treated with a portpolio-based learning model and the control class was taucht with conventional teaching scenario.

The data were analyzed with the two-way ANOVA using the SPSS 16 to see the effect of portfolio-based learning models and self-regulated learning on students' creative thinking skills.

2. Results and Discussion

This research was conducted at SMAN 15 Tanjung Jabung Barat in the even semester of the 2019/2020 school year. The data obtained in this study are the data of students creative thinking skills collected using tests. Test data is processed with the help of SPSS. The self regulated learning questionnaire data obtained at the beginning of the learning process. The data is processed using quantitative descriptive techniques. Self regulated learning data is obtained from a self regulated learning questionnaire that is given at the beginning before the learning process is carried out, this aims to categorize students who have high self-regulation and students who have low self-regulation. The self regulated learning questionnaire data is presented in Table 1.

Table 1
Self Regulated Learning Questionnaire Data

Class	Average	Criteria	Total Students
Experiment	3.59	High Self Regulated Learning	29
	2.92	Low Self Regulated Learning	2
Control	3.50	High Self Regulated Learning	26
	2.61	Low Self Regulated Learning	5

From these data it can be seen in the experimental class that the number of students who have high self-regulation is more than the number of students who have low self-regulation and vice versa in the control class. It is seen that the average experimental class students have higher self-regulation than the control class.

Data on students creative thinking skills were obtained from the results of tests conducted after being given treatment in the control class or in an experiment. Data on students creative thinking skills are presented in Table 2.

Table 2
Data on Students Creative Thinking Skills

Class	Maximum	Minimum	Q1	Q2	Q3	Average
Experiment	85	67.5	72.5	75	80	76.13
Control	75	55	62.5	67.5	71.25	66.61

Quartile (Q) is a measure of the location that divides measured data or grouped data into four equal parts (Pratikno et al., 2020). Q1 is the first quartile, Q2 or also called median is the second quartile and Q3 is the third quartile.

Then to see more clearly the data of students creative thinking skills presented in graphical form in Fig 1.

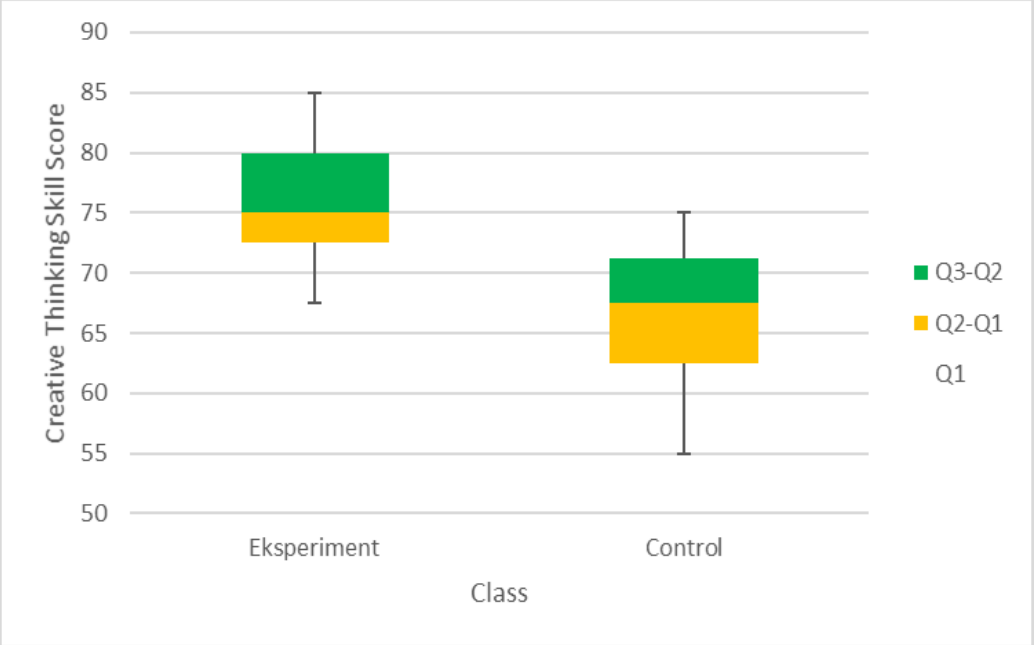

Fig 1. Block plot the data of student's creative thinking skills

The hypothesis of this study is that there are differences in the creative thinking skills of students who learn to use portfolio-based learning models and conventional learning models. Data obtained from the results of tests conducted after being given treatment in class. Hypothesis testing begins with tests of normality and

homogeneity then the data is processed using SPSS. The following is the normality of students creative thinking skills in Table 3.

Table 3
Data on normality test results of students creative thinking skills

Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Experiment class	.141	31	.120	.951	31	.162
Control class	.141	31	.117	.944	31	.105

Data on the results of students creative thinking skills using homogeneity test is taken from the variance data or f test on the spss. All student data totaling 62 students were tested and the statistical levene was obtained. The following is presented the homogeneity test results of students creative thinking skills in Table 4.

Table 4
Homogeneity test data results the value of students creative thinking skills

	Levene Statistic	df1	df2	Sig.
Postest	.059	1	60	.808

Based on the normality and homogeneity test obtained normal and homogeneous data. So to test the hypothesis can use parametric statistics, namely the two-way ANAVA test. Following are the two path anova test data results presented in Table 5.

Table 5
Two-way ANAVA test data

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1864.434[a]	3	621.478	37.198	.000
Intercept	95509.543	1	95509.543	5716.576	.000
Model	362.692	1	362.692	21.708	.000
Self_Regulated_Learning	405.545	1	405.545	24.273	.000
Model * Self_Regulated_Learning	.715	1	.715	.043	.837
Error	969.033	58	16.707		
Total	318650.000	62			
Corrected Total	2833.468	61			

Based on the results of the two-way ANAVA test in Table 5 above, it can be obtained that there is an influence of portfolio-based learning models on students creative thinking skills, there is an effect of self-regulated learning on students creative thinking skills and there is no interaction between portfolio-based learning

models and self-regulated learning on students creative thinking skills on acid and base material.

Students 'self-regulated learning (high and low) influences students' creative thinking skills independently. This is because that self-regulated learning is self-regulation of students in learning to take an action during the learning process. Self-regulation in learning as an active and constructive process in which students set learning goals, implement strategies, and monitor progress towards achieving goals, which involve cognition, metacognition, motivation, affection, and student behavior in learning (Deasyanti & Rangkuti, 2007). So students who have high levels of self-regulation will produce creative thinking skills compared to low levels of self-regulation. This is in line with research reveals that there is a positive relationship between self regulated learning and learning outcomes in the realm of knowledge. This is due to the existence of good self-regulated learning that will affect learning outcomes for the better (Ahmar, 2016).

3. Conclusion

Portfolio-based learning models and students self regulated learning have an affect on the students creative thinking skills with acid and base teaching materials. No interaction is detected based on statistical test between portfolio-based learning models and self-regulated learning on student's creative thinking skills. Each affects creative thinking skill independently.

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