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The Effect of Problem-Based Learning and Discovery Learning on Students' Critical and Creative Thinking Skills on the Development of the Islamic Empire

Muhammad Eko Subagtio [1)], Nasution [2)], M. Jacky [3)]*

1) Postgraduate of Social Studies Program, Universitas Negeri Surabaya, Indonesia
2, 3) Faculty of Social Science and Law, Universitas Negeri Surabaya, Indonesia

Abstrak

Penelitian ini bertujuan untuk mengetahui : 1) perbedaan pengaruh *problem based learning* dan *discovery learning* terhadap keterampilan berpikir kritis dan kreatif siswa, 2) pengaruh *problem based learning* dan *discovery learning* terhadap keterampilan berpikir kritis dan kreatif siswa secara simultan. Jenis penelitian ini adalah eksperimen semu dengan desain *nonequivalent comparison-group design*. Pengumpulan data menggunakan *pre-test* dan *post-test* pada kelas eksperimen I dan II. Teknik analisis data menggunakan uji *independent sample test* dan Manova dengan bantuan aplikasi *IBMM SPSS Statictics* versi 23. Hasil dari uji *independent sample test* menunjukkan variabel berpikir kritis memperoleh skor t_{hitung} 2,180 > t_{tabel} 1,996 dengan df. 66 dan variabel berpikir kreatif dengan skor t_{hitung} 2,103 > t_{tabel} 1,996. Berdasarkan hasil tersebut dapat disimpulkan bahwa terdapat perbedaan pengaruh terhadap keterampilan berpikir kritis dan kreatif. Pada hasil uji Manova memperoleh signifikansi 0,26 < 0,05 sehingga disimpulkan terdapat pengaruh terhadap keterampilan berpikir kritis dan kreatif secara simultan pada materi perkembangan kerajaan Islam. Dari hasil komparasi menunjukkan *discovery learning* lebih berpengaruh terhadap keterampilan berpikir kritis dan kreatif dengan n-gain sebesar 0,49, dibandingkan dengan *problem based learning* dengan n-gain 0,41.
Kata Kunci : problem based learning, discovery learning, keterampilan berpikir kritis dan kreatif.

Abstract

This study aims to determine: 1) the difference in the effect of problem based learning and discovery learning on students' critical and creative thinking skills, 2) the effect of problem based learning and discovery learning on students' critical and creative thinking skills simultaneously. This type of research is a quasi-experimental design with a nonequivalent comparison-group design. Collecting data using pre-test and post-test in the experimental class I and II. The data analysis technique used the independent sample test and Manova test with the help of the IBMM SPSS Statistics version 23 application. The results of the independent sample test showed that the critical thinking variable obtained a score of t_{count} 2.180 > t_{table} 1.996 with df. 66 and creative thinking variable with a score of t_{count} 2.103 > t_{table} 1.996. Based on these results, it can be concluded that there are different effects on critical and creative thinking skills. In the Manova test results obtained a significance of 0.26 <0.05 so that it can be concluded that there is an effect on critical and creative thinking skills simultaneously on the material for the development of the Islamic empire. The comparison results show that discovery learning has more influence on critical and creative thinking skills with an n-gain of 0.49, compared to problem-based learning with an n-gain of 0.41.
Keywords*: problem based learning, discovery learning, critical and creative thinking skills*

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*Corresponding author:
E-mail: ekosubagtio@gmail.com
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INTRODUCTION

In this modern era in the 21st century, globalization has become an actual challenge in the world of education. In addition to utilizing ICT developments in student learning, the education system in Indonesia is also expected to be able to equip students with learning skills and life skills, including critical and creative thinking skills (Redhana, 2019: 2249; Kharbach, 2012 in Fuad, et al., 2015: 807). Critical thinking specifically has become a skill that is quite important for the success of students. Analysis and reasoning are the keys to developing critical thinking (Al-Husban, 2020: 83). Cheong and Cheung (2008: 559) state that critical thinking can be taught by providing a problem through discussion forums, thus providing opportunities for students to observe, read, and discuss. Learning activities that aim to train thinking processes, generally only emphasize convergent thinking processes, which are limited to verbal reasoning, and logical thinking so that if students face a real problem, they will have difficulty solving the problem creatively (Haryanto, 2006: 2-3). Sani (2014:15) suggests that creative thinking is the ability to develop ideas or ideas that are unusual (out of the box), of high quality, and according to logic.

This study shows that critical and creative thinking skills are very important for students to master. These two thinking skills can be a provision for them in social life in the community. However, the role of schools that teach critical thinking skills is very little (Jacqueline and Brooks in Santrock, 2010: 360). Even the creative thinking skills possessed by graduates of elementary school to tertiary education are still relatively low. The low critical and creative thinking skills are due to this aspect of thinking skills that have not been handled properly in schools (Munandar, 2009: 31). Several ways can be done to improve the process and learning outcomes of students, including through Problem Based Learning (Yew & Goh, 2016: 78) and Discovery Learning (Druckman & Ebner, 2017: 21). Jerome Bruner is the figure who initiated the PBL learning model based on the discovery learning concept that he developed (Arends, 2008: 402; Suprijono, 2009: 68).

In the pandemic era, it is a challenge to apply PBL and discovery learning models. Online learning is one of the efforts to stem the spread of COVID-19, with the hope of reducing crowds and preventing crowds in the educational environment (SE Kemdikbud no. 15 of 2020). In Bojonegoro Regency, the implementation of learning at the high school level is carried out virtual and face-to-face which is attended by 50% of the total number of students in one class, they learn face to face in turn. This blended learning method has been running since November of the 2020/2021 school year. The media used in blended learning is the result of an agreement between the teacher and students, provided that each has been able to operate it (Subagtio, 2020: 161). The Edmodo application was chosen as a learning medium because it can be used for free, has more complete features, and has a graphic user interface (GUI) that resembles social media (Kuntarto, 2018: 17-20).

The use of Edmodo in problem-based learning and discovery learning models can be applied to certain subjects, for example in Indonesian history subjects. Among the subject matter of Indonesian history, one of them is the development of the Islamic empire. Islamic history learning materials invite, understand, and appreciate Islamic culture, which then becomes the basis for their way of life through guidance, teaching, training, use of experience and habituation. In the context of learning, Islamic history has several functions, including educational functions, scientific functions, and transformation functions (Karim, 2013: 7). To realize these functions, Islamic history learning requires an integrated approach from several other social science disciplines such as anthropology, politics, sociology and others so that learning is not dry and more comprehensive.

Based on the background of the problems above, the objectives of this research are to find out: 1) Are there any differences between the Problem Based Learning and Discovery Learning models based on blended learning with the Edmodo application on students' critical and creative thinking skills in the development of the Islamic empire 2) Are there the effect of Problem Based Learning and Discovery Learning based on blended learning with the Edmodo application on students'

critical and creative thinking skills simultaneously on the material for the development of the Islamic empire.

There are many studies conducted on the effect of PBL on critical thinking skills such as those conducted by Yuan, et al. (2008: 85), El-Shaer and Gaber (2014: 74), Herzon, et al. (2018: 42), and Amin, et al. (2020: 743). While research on the effect of PBL on creative thinking skills was carried out by Birgili (2015: 73), Orozco & Yangco (2016: 7), Ulger (2018), Rudibyani (2019: 6), Armana, et al (2020: 63). The effectiveness of increasing creative thinking skills can also be done through the application of discovery learning, such as the results of research conducted by Tumurun, et al. (2016: 101), Rahman (2017: 101), Nurlaela, et al. (2019: 65), and Juniarso (2020: 40). In addition to influencing increasing creative thinking skills, discovery learning is also effective in improving critical thinking skills such as the results of research from Rudibyani (2018: 50) which adapts Bruner's theory that discovery-based learning makes students actively seek knowledge so that it will provide the best learning outcomes. These findings are in line with the results of research from Coal (2019: 118), Sucipta, et al. (2018: 4) and Nurmayani (2020: 239).

METHOD

This study uses a quantitative approach to the type of quasi-experimental method. The research design used is a nonequivalent comparison-group design. The essence of this design is to compare two groups of classes that are given a comparable type of learning treatment (Johnson & Christensen, 2014: 359). Both experimental groups were given a pre-test to measure initial ability. Then the treatment was given with different but still comparable types, namely Problem based Learning in the X-IPS 2 class group and Discovery Learning in the X - IPS 1 class group, each class consisting of 35 students. The research location is at SMAN 2 Bojonegoro. The study was conducted in 4 meetings, from April 5 to May 4, 2021. The data analysis techniques used to answer the research hypothesis were independent sample tests and multivariate analysis of variance with the help of the IBM SPSS statistics version 23 application.

Table 1. Nonequivalent comparison-
design group (Johnson & Christensen, 2014: 359)

Group	Pre-test	Treatment	Post-test
Experiment$_1$	O_1	X_1	O_2
Experiment $_2$	O_3	X_2	O_4

The indicators used in assessing critical thinking skills are interpretation, analysis, evaluation, inference, explanation, and self-regulation (Facione, 2011: 5). Meanwhile, the indicators used to assess creative thinking skills consist of fluency, flexibility, originality, and elaboration (Bosch, 2008; Munandar, 2009: 32).

RESULTS AND DISCUSSION

Results

The data collected from the results of the assessment of critical and creative thinking skills in each class is then used as primary data to be processed. However, the results of the collected values are still in the form of raw scores. Therefore, it is necessary to carry out a prerequisite test as the basis for statistical hypothesis testing, some of these prerequisite tests include normality, homogeneity, and homogeneity tests of the variance-covariance matrix / Box's M.

Pearson Product Moment Validity Test

The validity of students' critical thinking skills was calculated using the Pearson product moment formula with the help of the IBM SPSS Statistics version 23 application. The research instrument in the form of essay questions was said to be valid if the value of $r_{count} > r_{table}$. The r_{table} provisions

for the amount of data n = 32 and a significance of 0.05 is 0.349. Data on the results of the instrument validity test of students' critical thinking skills are presented in the following table:

Table 2. The results of the validity of critical thinking questions

No.	Test Validity	r_{count}	r_{table}	Description
1.	Question number 1	0,657	0,349	Valid
2.	Question number 2	0,722	0,349	Valid
3.	Question number 3	0,771	0,349	Valid
4.	Question number 4	0,697	0,349	Valid
5.	Question number 5	0,771	0,349	Valid

Table 3. The results of the validity of creative thinking questions

No.	Test Validity	r_{count}	r_{table}	Description
1.	Question number 1	0,796	0,349	Valid
2.	Question number 2	0,671	0,349	Valid
3.	Question number 3	0,671	0,349	Valid
4.	Question number 4	0,850	0,349	Valid
5.	Question number 5	0,826	0,349	Valid

Based on the results of the validity test of each item in Tables 2 & 3, all students' critical thinking ability test items show a value of $r_{count} > r_{table}$, so it can be said that all items about critical and creative thinking skills are in the valid category and can be used as data collection instruments.

Homogeneity Test

The reliability of the student's critical thinking skill question sheet was tested using the Cronbach's Alpha formula. The criteria for determining the instrument reliability limit is 0.6 (Sujarweni, 2014: 199). The results of the reliability test of students' creative thinking skills are shown in the following table:

Table 4. Critical thinking reliability results

Reliability Statistics	
Cronbach's Alpha	N of Items
0,848	5

Table 5. Critical thinking reliability results

Reliability Statistics	
Cronbach's Alpha	N of Items
0,848	5

Based on table 4 & 5, the Cronbach's Alpha score of the student critical thinking skill question sheet instrument is 0.809 > 0.6, while for creative thinking skills of 0.848 > 0.6, it can be concluded that the instrument is reliable.

Normality test

Normality test is used to test whether the data is normally distributed or not. The normality test used the Saphiro-Wilk formula with a significance level of 0.05 or 5%, with the help of the IBM SPSS Statistics version 23 application. The decision-making guideline is that if the significance value is <0.05, the data is not normally distributed. However, if the significance value is > 0.05 then the data is normally distributed. The results of the normality test are shown in the table and histogram below:

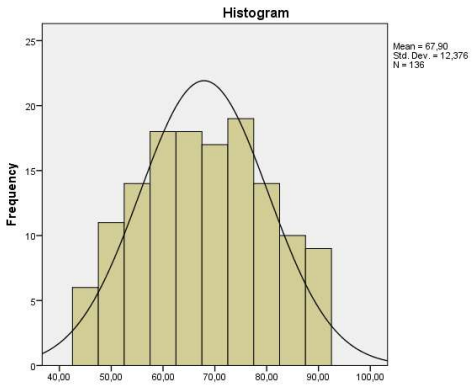
Table 6. The normality test of critical thinking

Class	Shapiro-Wilk		
	Statistic	df	Sig.
Pre-test Experiment I	0,941	34	0,066
Post-test Experiment I	0,954	34	0,161
Pre-test Experiment II	0,949	34	0,114
Post-test Experiment II	0,940	34	0,063

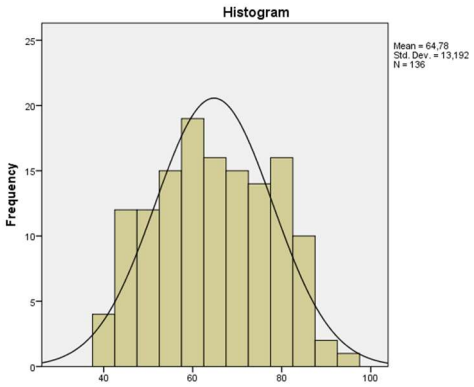
Table 7. The normality test of creative thinking

Kelas	Shapiro-Wilk		
	Statistic	df	Sig.
Pre-test Experiment I	0,952	34	0,140
Post-test Experiment I	0,961	34	0,256
Pre-test Experiment II	0,946	34	0,095
Post-test Experiment II	0,964	34	0,311

Based on the data in tables 6 & 7, shows that all variables have a significance value of more than 0.05, so it can be stated that all research variables are normally distributed. The distribution of the data is shown in the histogram below:



Picture 1. Critical thinking normality test curve



Picture **2.** Creative thinking normality test curve

Homogeneity Test

This homogeneity test was conducted to test the similarity of several parts of the sample. Homogeneity testing was carried out using the Levene Test. Based on table 8, shows the homogeneity of the critical thinking variable at 0.174 > 0.05 and the creative thinking variable at 0.504 > 0.05. So it can be concluded if the two variables are homogeneous. Based on the normality and homogeneity tests that have met the requirements, it can be continued on the independent sample test hypothesis test.

Table 8. The results of the homogeneity test of critical and creative thinking

	F	df1	df2	Sig.
Berpikir Kritis	1,887	1	66	0,174
Berpikir Kreatif	0,451	1	66	0,504

Homogeneity Test of Variant-Covariance Matrix / Box's M

In performing the MANOVA test, in addition to the variance of the data groups, the variance/covariance matrix of the dependent variable must also be the same. To test the homogeneity of the variance/covariance matrix, it can be seen from the results of Box's M test. The results of the Box's M test are as follows:

The Box's M value is 4.187 with a significance of 0.256. If the research significance level is 0.05, then the Box's M significance is 0.256 > 0.05, which indicates that Ha is accepted. So it can be concluded that the variance/covariance matrix of the dependent variable is the same. Therefore, the test can be continued on the multivariate analysis of variance test.

Independent Sample Test

The first problem formulation hypothesis was tested using an independent sample test. The aim is to find out the difference in the effect of problem-based learning and discovery learning based on blended learning with the Edmodo application on students' critical and creative thinking skills. The results of the independent sample test calculation are presented in the table below:

Table 9. The results of the independent sample test

		t-test for Equality of Means						
		T	df	P Value	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Critical Thinking	Equal variances assumed	-2,180	66	0,033	-4,70588	2,15828	-9,01503	-0,39674
	Equal variances r assumed	-2,180	63,099	0,033	-4,70588	2,15828	-9,01873	-0,39304
Creative Thinking	Equal variances assumed	-2,103	66	0,039	-4,26471	2,02755	-8,31284	-0,21657
	Equal variances r assumed	-2,103	65,200	0,039	-4,26471	2,02755	-8,31377	-0,21564

Based on table 9, shows the results of the analysis with the independent sample test on the critical and creative thinking skills variable obtaining a negative t_{count} score because the average value of experimental group I is lower than the value of the experimental group II. The critical thinking variable has a t_{count} score of 2.180 > t_{table} 1.996 with df. 66. On the results of sig. 2 tails got a score of 0.033 < 0.05. Therefore, H_a is declared accepted because the value of t_{count} is greater than ttable and the value of sig. 2 tails is smaller than 0.05. Thus, it can be stated that there is a difference in the effect of problem-based learning models and discovery learning based on blended learning with the Edmodo application on critical thinking skills.

The creative thinking variable obtained a t_{count} score of 2.103, > t_{table} 1.996, and the results of sig. 2 tailed with a value of 0.039 < 0.05. Therefore, H_a is declared accepted because the value of t_{count} is greater than t_{table} and the value of sig. 2 tails is smaller than 0.05. Thus it can be stated that the difference in the effect between problem-based learning models and discovery learning based on blended learning with the Edmodo application on students' creative thinking skills.

Multivariate Analysis of Variance (MANOVA)

The Manova test was conducted to test the third hypothesis of the study. The aim is to find out whether there is an effect on problem-based learning and learning of the discovery of critical and creative thinking skills simultaneously on the development of the Islamic kingdom. The test was carried out with the help of the statistical program IBM SPSS version 23 at a significance level of 5%. Manova test results are as follows:

Table 10. Multivariate test results

	Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Class	Pillai's Trace	0,106	3,849[b]	2,000	65,000	0,026	0,106
	Wilks' Lambda	0,894	3,849[b]	2,000	65,000	0,026	0,106
	Hotelling's Trace	0,118	3,849[b]	2,000	65,000	0,026	0,106
	Roy's Largest Root	0,118	3,849[b]	2,000	65,000	0,026	0,106

The results of the analysis indicate that the significance value of the class variables for the Pillae Traice, Wilk Lambda, Hotelling's Trace, and Roy's Largest Root categories has a significance value of 0.026 < 0.05. This shows that the values for Pilae Traice, Wilk Lambda, Hotelling's Trace, and Roy's Largest Root are all significant. So it can be concluded that there is a significant influence between problem-based learning and discovery learning models on critical and creative thinking skills simultaneously on the material development of the Islamic empire.

Table 11. Descriptive statistical results

Variable	Result	Experiment I	Experiment II
Critical Thinking	N	68	68
	Minimum	55	60
	Maximum	90	90
	Mean	74,12	78,82
	Std. Deviation	9,80	7,89
	N-Gain	0,39	0,49
Creative Thinking	N	68	68
	Minimum	55	90
	Maximum	60	95
	Mean	72,65	76,91
	Std. Deviation	8,81	7,88
	N-Gain	0,43	0,49

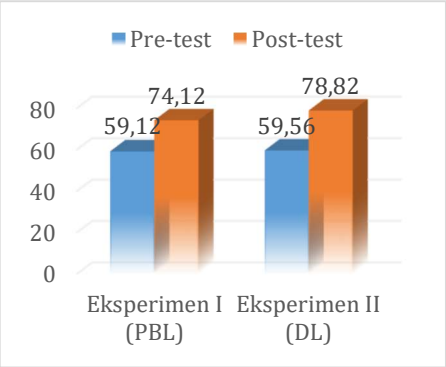


Figure 3. Comparison graph of critical thinking skills

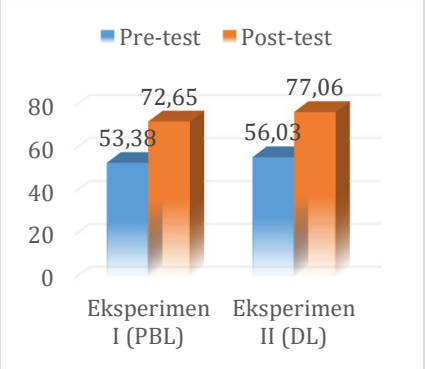


Figure 4. Comparison graph of creative thinking skills

The difference in the average value of students' critical thinking skills in experimental class I (PBL) was 74.12 and the experimental class II (DL) was 78.82. So it can be interpreted that the discovery learning model is more effective than the problem-based learning model on improving students' critical thinking skills with an n-gain of 0.49, this is in line with the results of research by Aritonang & Astuti (2021: 163), and Safitri & Setiawan (2020: 57) which states that discovery learning is more effective than problem-based learning as well as different from the research results of Prasetyo & Kristin (2020: 22-23) which state that problem-based learning is more effective than discovery learning on students' critical thinking skills.

The difference in the average value of students' creative thinking skills in the experimental class I (PBL) was 72.65 and the experimental class II (DL) was 77.06. So it can be interpreted that the discovery learning model is more effective than the problem-based learning model on increasing students' creative thinking skills with an n-gain value of 0.49, this is in line with the results of the research by Adawiyah & Disman (2020: 37) which states that discovery learning is more effective compared to problem-based learning on students' creative thinking skills. In the results, the average value of students in both classes showed a tendency for higher scores in the critical thinking skills category of 76.47 compared to creative thinking skills with an average of 74.85.

Discussion

During this pandemic, the number of students attending school is only allowed to be 50% of the total students in one class, therefore learning is carried out using blended learning. Learning activities in the classroom with PBL and discovery learning are carried out according to the syntax (Arends, 2008: 57; Syah, 2004: 244) and the learning implementation plan that has been validated by expert validators. The lesson begins with apperception and introductory material by the researcher. Next, the researcher gives a case/problem in the PBL class, students are required to be able to discuss finding solutions or responses to the problem. While in the discovery learning class, the problem is not given by the researcher, but the students themselves are asked to find and formulate a solution or the results of the analysis. The learning activities were carried out in small groups formed by researchers at random. They are free to use any source of material to support their learning activities. This learning pattern is carried out offline (face to face) at school.

As for students who are studying online, they can take part in learning through the Edmodo application. Researchers deliberately chose the Edmodo application because it can be used for free, has more complete features, and has a graphic user interface (GUI) that resembles social media. It is also a new experience for students from previously only using the Google Classroom application. One of the highlights of Edmodo is the availability of the small group feature to divide students in one class into several small groups for discussion. This feature is not shared by other free learning applications such as Google Classroom which they often use. Therefore, the use of Edmodo as a learning medium is very helpful in every step of PBL and discovery learning. So that the application of PBL and discovery learning is not much different between offline (face-to-face) and online classes.

PBL and discovery learning models have helped students to demonstrate critical thinking activities through problems that are solved together in one group. Through group discussions, students can reach the zone of proximal development, namely higher abilities obtained from the help of others. The footing of PBL and DL models is based on the concept of scaffolding (Arends, 2008: 402)

According to Vygotsky's theory of constructivism, knowledge will be more developed when students can perform social interactions with their environment. The basic assumption of Vygotsky's constructivism theory is that problem solving that children do by working together today, will be able to do independently in the future (Warsono & Hariyanto, 2012: 59). In line with this thought, the learning models applied in this research are PBL and discovery learning, both of which are social-based learning models and emphasize learning in an interactive dialogue. Learning in experimental classes I and II emphasize social interaction with other people, either directly or through the Edmodo application.

In this study, PBL and discovery learning provides opportunities for students to think creatively through open-ended situations that are discussed in groups. Questions that provide problems openly can be answered by students from various perspectives. According to Arends & Kilcher (2010: 328), it is stated that inquiry in problem-based learning requires critical thinking skills and open-ended situations which can later lead to creative thinking skills. Through the ability to think creatively, students can have an understanding or idea to find a new solution to a problem. In the thinking process, students also have a sense of interest in solving problems so that they can foster curiosity. According to Steinemann (2003: 218), creative thinking can be developed through open-ended questions during class discussions and integrating problem-based scenarios in student learning activities.

In line with the findings of Arends & Kilcher and Steinemann, the instrument used in this study used questions in the form of essays. Students are not faced with questions that are accompanied by answer choices, the goal is that students can think broadly and deeply from the learning resources they read. Based on the results of the study, students felt that they could not find the answer for sure in just one article, they had to read many articles to be able to conclude the formulation of the right answer, of course requiring perseverance and higher thinking skills because questions cannot be answered through speculation.

Discovery learning is proven to improve critical and creative thinking skills compared to PBL. In the learning syntax, discovery learning requires students to think critically and creatively from the start by finding their problems related to the material as a learning theme. Meanwhile, problem-based learning requires students to solve problems given by the teacher. The difference between the two models is that discovery learning requires students to think critically and creatively twice, namely when finding problems and solving them, while problem-based learning requires students to think critically and creatively once when solving problems given by the teacher.

CONCLUSION

Based on the results of data analysis, the results of the discussion can be concluded that there is a difference in the effect between the application of problem-based learning and discovery learning models on students' critical and creative thinking skills in the development of the Islamic kingdom. Although the two learning models are implemented in a blended learning way, they can run well according to their syntax with the help of the Edmodo application, so that they can have a simultaneous influence on critical and creative thinking skills. Critical thinking skills are obtained through solving a problem that is done together. Creative thinking skills are obtained through the provision of open-ended questions so that students can think broadly with various perspectives. Discovery learning is proven to be more able to improve students' critical and creative thinking skills compared to problem-based learning because discovery learning requires students to think critically and creatively twice, namely when finding problems and solving efforts.

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