



The Influence of Student Activities in Project Based Learning on High School Students' Creative Thinking Abilities in Making Dry Herbariums

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Abstract

One of the government's efforts to support 21st century education is by implementing a new education program known as the independent learning program, one of which is driving schools. One of the dimensions of the Pancasila student profile in driving schools is that students must be able to think creatively. In developing creative thinking skills, students must be active in the learning process so teachers need to design learning patterns that can involve students being active in order to influence creative thinking abilities. The research design used was a pre-experimental design with a one group pre test-post test design. The sampling technique used purposive sampling with a sample size of 45 students. The data collection technique uses tests and observations which are analyzed using quantitative descriptive analysis and simple linear regression analysis. The research results showed that 76% of students were able to reach the medium level creative category, namely in the aspects of flexibility, originality and elaboration. Student activities in project-based learning have a significant effect on students' creative thinking abilities. The influence of student activities in project-based learning on creative thinking skills is 21.1% with a significance level of $0.002 < 0.05$. There is a positive correlation between student activities in project-based learning and creative thinking abilities. For every 1% increase in student activity scores in project-based learning, the creative thinking ability score increases by 1.440.

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INTRODUCTION

21st century education is the era when education is incorporated with science and technology. In improving the quality of education in the 21st century, educators must be more flexible in adapting to changing times. One of the government's efforts to support 21st century education is by implementing a new program, namely the independent learning (Merdeka Belajar) program proposed by the Minister of Education and Culture, Mr. Nadiem Makarim. The Rumah Belajar Team (2021) explains that the independent learning program consists of independent campuses, driving teachers and driving schools. The vision and mission in the driving school curriculum is included in the Pancasila student profile. According to Widdiharto (2021), the Pancasila student profile contains six dimensions, namely 1) having good morals, having faith and being devoted to God Almighty; 2) global diversity; 3) independent; 4) work together; 5) critical thinking; 6) creative thinking. Due to the demands of an independent curriculum, students are expected to be able to master six dimensions, one of which is creative thinking. The government realizes the importance of developing the creativity of Indonesia's young generation so that they are ready and able to compete with the challenges of global life in the 21st century. Therefore, the learning system in schools must begin to focus on developing students' creative abilities (Sukarso et al., 2019). It is hoped that an appropriate learning system can train students to be active in learning so that they can train students to think creatively.

Creative thinking is defined as the ability to formulate new ideas or products that are amazing and valuable in many ways (Ramadhan et al., 2019). The ability to think creatively is needed in scientific procedures carried out by scientists, such as: developing sensitivity to existing problems, encouraging the formulation of new ideas, building new models, finding the right answer or solution to a problem and finding failure factors in investigations (Ramadan et al., 2019). Students' success in developing creative thinking skills can be seen from the achievement of several indicators that students have mastered. According to Munandar (2009) creative thinking consists of 4 aspects or indicators which include fluency, flexibility, originality, and elaboration. Creative thinking can encourage students to formulate many ideas or thoughts in solving a problem.

Creative thinking is one of the soft skills that students must have in the learning process, one of which is in biology. In accordance with the opinion of Sari et al (2021), the ability to think creatively is one of the main assets for students in studying science, especially biology, because biology is a branch of science that plays a big role in the currently developing fields of science and technology. Students who are creative will innovate in expressing ideas which will later have value in improving their own quality. Each student has a varying level of creative thinking, from low level to high level.

Students' creative thinking abilities can be influenced by the learning patterns implemented by teachers at school. Learning patterns that are able to involve students to be active in learning will certainly have a different influence from learning patterns that do not involve students being active during the learning process. According to Anggraini & Wulandari (2021), student activities in learning are able to develop talents, train students to reason critically, and help students solve problems. If students learn by doing activities, they will gain knowledge, understanding, and other aspects that can develop meaningful skills. In this case, teachers need to design a learning process that is able to involve students actively so that they can develop students' abilities, one of which is the ability to think creatively.

Project-based learning is a learning model that can train students to actively learn independently through creating projects. According to research by Ariyani et al (2019),

the project-based learning model (PjBL) is able to make students independent in learning, motivate and train students to work together in teams, and generate creative ideas. The application of the PjBL model produces products that show students' thinking critically and creatively. The application of the PjBL model focuses on students' ideas, namely forming their own images of relevant topics and issues that are in accordance with students' daily experiences.

Project-based learning has been carried out by several researchers before. The research results of Azzahra et al (2023) state that project-based learning is very influential in improving students' creative thinking abilities. In line with research by Maquita & Tobeli (2022) that if project-based learning is implemented well in the classroom learning process, students' creative thinking skills will increase. Learning will be more meaningful when teachers are able to teach students how to solve real problems in the surrounding environment, so that they can develop soft skill competencies, one of which is the ability to think creatively and not only focus on cognitive abilities. The aim of this research is to analyze students' creative thinking profiles and the influence of student activities in project-based learning on creative thinking abilities.

RESEARCH METHOD

The research is quantitative research with a pre-experimental design. The type of design used is One-Group Pre test Post test Design. The research group only used an experimental class by providing project-based learning model treatment. The research design is as follows.

R: O₁ X O₂

Keterangan

R : Experimental Group

X : Treatment (Project Based Learning Model)

O₁ : Initial Measurement

O₂ : Final Measurement

In this study, it only consisted of an experimental group. Before giving treatment, an initial measurement of students' cognitive abilities is first carried out by giving a pre-test. Next, students (experimental group) were treated with a project-based learning model and made projects in the form of dry herbarium in groups. After the treatment, a final measurement of student learning outcomes was carried out by giving a post test. In this case, researchers also observed students' activities in project-based learning and creative thinking abilities.

The research population was class X students at SMAN 1 Banjarharjo, totaling 350 students. The sampling technique used in the research is purposive sampling. The sample consisted of classes X1 and X4, totaling 45 students. Samples were taken according to the advice of the Biology teacher at SMAN 1 Banjarharjo with certain considerations. Research variables include independent variables and dependent variables. The independent variable is student activity in project-based learning. The dependent variable is students' creative thinking abilities. The data collection technique uses tests and observations. Data analysis techniques use quantitative descriptive analysis and simple linear regression analysis.

RESULTS AND DISCUSSION

A. Results of quantitative descriptive analysis of creative thinking abilities

Quantitative descriptive analysis was carried out to analyze students' creative thinking abilities in each aspect of creative thinking. So we can know the level of

students' creative categories in each aspect of creative thinking. The results of the quantitative descriptive analysis of creative thinking aspects can be seen in table 1.

Table 1. Results of Descriptive Analysis of Creative Thinking Aspects

	N	Minimum	Maximum	Mean	Standart Deviation
<i>Fluency</i>	45	25	33	25.53	2.018
<i>Flexibility</i>	45	42	67	52.58	10.270
<i>Originality</i>	45	25	62	44.18	13.883
<i>Elaboration</i>	45	42	83	57.02	13.377
<i>Valid N (listwise)</i>	45				

Based on table 1, it can be seen the creative level categories for each aspect of creative thinking, which include fluency, flexibility, originality and elaboration. The creative category level refers to the creative category according to Arikunto (2010) as presented in table 2. Based on the average score for each aspect of creative thinking, it shows that in the aspect of fluency, students' creative thinking abilities are included in the low category. Fluency is the ability to generate many ideas (Agustrin & Rindrayani, 2022). Fluency can be seen when students provide interpretations of initial questions related to the learning topic. This is in accordance with the opinion of Rafik et al (2022) that at this stage, students are able to digest and understand problems, convey information based on their own abilities and language and directly think about what products can be made based on the questions asked, so that this phase can help students think creatively, especially aspects of fluent thinking and flexible thinking. In the aspect of flexibility, students' creative thinking abilities are included in the medium category. Flexibility is the ability to come up with various solutions or approaches to problems (Agustrin & Rindrayani, 2022). Flexibility can be seen in the activities of preparing schedules and making project designs. This is in accordance with the opinion of Wahida et al (2015) that the activities of preparing schedules and designing projects will train indicators of flexible thinking abilities. In the aspect of originality, students' creative thinking abilities are included in the medium category. Originality is the ability to generate ideas in ways that are original, not cliché, and are rarely given to most people (Agustrin & Rindrayani, 2022).

Originality can be seen at the project creation stage, at this stage students design and complete projects from the results of their own thoughts, thus training students to provide solutions based on their own thoughts. This is in accordance with the opinion of Wulandari et al (2019) that in project learning, students are required to be able to construct their knowledge based on previous real experiences so that in this activity there is involvement in training students' original thinking abilities. In the aspect of elaboration (detailed thinking), students' creative thinking abilities are included in the medium category. Detailed thinking is the ability to put forward various ideas to solve problems from various points of view (Suyidno et al., 2018). Detailed thinking can be seen when students present project results. At this stage students can present their project results in groups in their own way. This is in accordance with the opinion of Utami et al (2015) that each group has its own way of conveying the results of their projects and thinking in detail (elaboration), that is, students can detail and develop the results of the observations they get so that they can find solutions to solve problems. In line with the opinion of Hsieh et al., (2013) who stated that project-based learning provides students with the opportunity to work in groups to stimulate creativity, express ideas and solve

problems. Project-based learning trains students to discuss in solving a problem so that students can express many ideas from their own thinking.

Table 2. Creative Level Category

Categories	Interval
Very Low	0 – 20
Low	21 - 40
Medium	41 - 60
High	61 - 80
Very High	81 – 100

Source: (Arikunto, 2010))

Next, to find out the percentage of students in the creative category, an analysis of the frequency distribution of creative thinking abilities was carried out as presented in table 3. Based on the frequency distribution table, it shows that 24% of students are in the low creative level category and 76% of students are in the medium creative level category. In this case, 24% of the 45 students were able to show the aspects of flexibility and elaboration but were not able to show the aspects of fluency and originality. Meanwhile, the other 76% of students were able to show aspects of flexibility, originality and elaboration but were not able to show aspects of fluency. The emergence of students' creative thinking abilities can of course be caused by factors that influence creative thinking abilities. In the learning process, students are still not active in expressing ideas, planning and produce products that are unique and different from other students. In developing creative thinking skills, of course, stages are needed that can stimulate students to think creatively. According to Mahfud (2011), students cannot immediately think creatively, but there are stages that students must go through so that they are then able to think creatively. There are 4 stages of the creative thinking process according to Monty & Fidelis (2003), namely 1) preparation, at this stage students learn the background of the problem and its problematics; 2) incubation, at this stage the process of forgetting the context may occur and it will be remembered again when the next period appears; 3) science initiation, at this stage new problem solving ideas, solutions, ways of working and new answers emerge spontaneously; 4) verification, at this stage the activity of critically evaluating ideas appears which has begun to be matched with real conditions. In developing creative thinking skills, students must often be trained to be active in learning so that students are able to express their own ideas or thoughts.

Table 3. Frequency Distribution of Creative Thinking Ability

Creative Thinking Score	Frequency	Percent	Valid Percent	Cumulative Percent
34	5	11.1	11.1	11.1
36	5	11.1	11.1	22.2
39	1	2.2	2.2	24.4
41	11	24.4	24.4	48.9
45	5	11.1	11.1	60.0
47	6	13.3	13.3	73.3
55	6	13.3	13.3	86.7
57	3	6.7	6.7	93.3
59	3	6.7	6.7	100.0
Total	45	100.0	100.0	

B. Results of Quantitative Descriptive Analysis of Students' Cognitive Abilities

This analysis was carried out to determine students' cognitive abilities before and after treatment with the project-based learning model. The table of quantitative descriptive analysis results of students' cognitive abilities can be seen in table 4.

Tabel 4. Results of Quantitative Descriptive Analysis of Students' Cognitive Abilities

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Pre test	45	30.00	60.00	90.00	74.8889	11.65259
Post test	45	20.00	80.00	100.00	90.8889	5.96285
Valid N (listwise)	45					

Based on the table above, it can be seen that the average pre-test score is 74.89, while the average post-test score is 90.89. This shows that the average score of pre test < post test is $74.89 < 90.89$. Students' initial abilities also influence their creative thinking abilities. In line with the opinion of Mandasari (2016) that initial abilities are the abilities possessed by students before teaching and learning activities take place, students who have high initial abilities usually tend to be easier to accept the material taught by the teacher than students who have low initial abilities. Based on the results of the descriptive analysis of students' cognitive abilities at the start of learning, the average was 74.89 and there were still several students who scored below the Minimum Competency Criteria.

C. Results of Simple Linear Regression Analysis

Simple linear regression analysis was carried out to determine the causality of student activities in project-based learning on creative thinking abilities. The output of simple linear regression analysis consists of the coefficient of determination, ANOVA table, and regression coefficient.

1. Coefficient of Determination Test (R square)

The coefficient of determination test was carried out to determine the magnitude of the influence of student activities in project-based learning on students' creative thinking abilities. The coefficient of determination test results table is presented in table 5.

Tabel 5. Determination Test Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.459 ^a	0.211	0.192	3.121

Based on the table above, it is known that the R squared value is 0.211. This means that the influence of student activities in project-based learning on creative thinking abilities is 21.1%, while the remaining 78.9% is influenced by other factors outside the independent variables such as students' initial abilities, ability to exchange ideas and collaborate. in groups and the ability to solve problems. The correlation value shows a figure of 0.459, so it can be said that the level of correlation between the independent variable and the dependent variable is medium. In determining the level of correlation value relationship, researchers refer to the interpretation table according to Neolaka (2014) as shown in table 6.

Tabel 6. R Value Interpretation

Coeffisient Interval	Relationship Level
0,00	No Correlation
>0,00 – 0,199	Very Low
0,20 – 0,399	Low
0,40 – 0,599	Medium
0,60 – 0,799	Strong
0,80 – 0,999	Very Strong
1,00	Perfect Correlation

Source: (Neolaka, 2014))

2. F Test (Simultant)

The F test was carried out to determine the simultant influence of student activities in project-based learning on creative thinking abilities. To find out the F value, see table 7.

Table 7. ANOVA Result

Model	Sum of Square	Df	Mean Square	F	Sig.
1 Regression	111.826	1	111.826	11.483	0.002 ^b
Residual	418.752	43	9.738		
Total	530.578	44			

Based on the output of the ANOVA table above, the calculated F_{value} is 11.483 with a probability significance level of $0.002 < 0.05$. $F_{\text{value}} > F_{\text{table}}$ ($11,483 > 4,07$), so it can be concluded that there is a significant influence of student activities in project-based learning on creative thinking abilities.

3. Regression Equation

The regression equation is used to determine the direction of correlation of student activities in project-based learning on creative thinking abilities. The results of the regression coefficient can be seen in table 8. To find out the direction of the regression equation, the following regression equation is used:

$$Y = a + bX$$

Keterangan:

- a = Constant
 b = Regression coefficient
 X = Project-based learning model
 Y = Ability to think creatively

Tabel 8. Regression coefficient Result

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Standard Error	Beta		
(Konstan)	2.603	5.103		0.510	0.613
1 Student Activity in Project Based Learning	1.440	0.425	0.459	3.389	0.002

Based on the regression coefficient output table, the following regression equation is obtained:

$$Y = 2,603 + 1,440X$$

The results of the regression equation show a constant value of 2.603, which is the value of the dependent variable (Y) when the independent variable (X) is 0. The regression coefficient value of the variable then the value of creative thinking ability increases by 1.440. In this case, it shows that student activities in project-based learning have a positive correlation on creative thinking abilities. Apart from describing the regression equation, this output also displays the t value which aims to prove whether there is a partial influence between student activities in project-based learning on creative thinking abilities. Based on table 8, it can be seen that the tcount value is 3.389. This value shows that $t_{count} > t_{table}$ $3.389 > 1.680$, which means that there is an influence significant of student activities in project-based learning on creative thinking abilities. From the results of the regression coefficient output, it can also be seen that the significant value is $0.002 < 0.05$, which means that there is a significant influence between student activities in project-based learning on students' creative thinking abilities in making dry herbarium.

Based on the results of hypothesis testing using simple linear regression analysis, it shows that student activities in project-based learning have a significant effect on students' creative thinking abilities in making dry herbarium. There is a positive correlation between student activities in project-based learning and creative thinking abilities. A positive coefficient means that there is a unidirectional (positive) relationship between student activities in project-based learning and creative thinking abilities. The better the students' activities in project-based learning, the greater the students' creative thinking abilities. This is in accordance with research by Maquita & Tobeli (2022) that if the PjBL model is implemented well in the classroom learning process, students' creative thinking skills will increase. A significance value of $0.002 < 0.05$ indicates that student activities in project-based learning have a significant effect on creative thinking abilities. This is in accordance with the opinion of Kusumaningtyas et al (Kusumaningtyas et al., 2020) that there is a significant influence from using the PjBL model on students' creative thinking abilities with a significance figure of $0.000 < 0.05$. Student activities in learning can stimulate talent development, train students to think critically, and help in solving

problems in learning, so that teachers can plan the learning process to create active and conducive classroom conditions (Anggraini & Wulandari, 2021). Through project-based learning, teachers direct students to find and solve their own problems both individually and in groups by looking for various solutions through sources relevant to the problem to train students to express their own ideas.

This is in accordance with the opinion of Mulyani & Hamka (2023) that by using a project-based learning model, students are required to find solutions to problems that occur through various supporting sources so as to improve students' creative thinking abilities. Azzahra et al (2023) argue that if learning is carried out using a project-based learning model, it can develop students' creative thinking abilities which are influenced by the steps in the project-based learning model such as the teacher asking initial questions related to the learning topic, designing the project, making a schedule and project design, monitoring, assessing results and conducting evaluations and reflections at the end of learning. If students learn while working, they will gain knowledge, understanding and other aspects of behavior and develop meaningful skills (Widyaningrum, 2016). Project-based learning is quite accurate in leading students to think creatively even though it requires a relatively long time in learning and enthusiasm and an active role from both parties, both students and teachers (Salma, 2017). Project-based learning requires quite a long time so teachers and students must be able to utilize their time well.

CONCLUSION

Based on the research results, it shows that there is a significant influence of student activities in project-based learning on creative thinking abilities. Student activities in project-based learning have a positive correlation with creative thinking abilities. The results of the quantitative descriptive analysis showed that 76% of students were able to reach the medium level creative category, namely in the aspects of flexibility, originality and elaboration.

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