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INFLUENCE OF PROJECT BASED LEARNING (PjBL) MAKING BIOPLASTIC PRESERVANTS ON THE CREATIVE THINKING ABILITY OF STUDENTS IN THE MATERIAL OF BIODIVERSITY

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ABSTRACT

From the interview with the biology teacher at Taman Mulia Private High School, it can be seen that the students' creative thinking skills have not been fully trained and no special assessment has been carried out. Overcoming these problems can be done by using a learning model that can encourage students and improve the ability of creative thinking skills by providing systematic projects. The purpose of this study was to determine how much influence the project-based learning (PjBL) model of making bioplastic preserves has on students' creative thinking skills in biodiversity material. This research method is a quasi-experimental design using the Nonequivalent Control Group Design. The sampling technique used simple random sampling with class X IIS 1 as the experimental class using the PjBL learning model for making bioplastic preserves and class X IIS 2 as the control class using the discovery learning model. The results of the effect size of 1.16 are in the large category and it is concluded that there is an influence on the creative thinking skills of students.

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INTRODUCTION

Learning is a process where students can learn according to their needs. Learning can be interpreted as an effort to influence feelings, intellectual and spiritual in students to learn. Learning that is built by a teacher will increase every potential and various abilities of students, such as the ability to think, have creativity, reconstruct knowledge, solve problems, and so on. (Angga et al., 2022).

The development of the curriculum in Indonesia shows that the times are very fast. The direction and purpose of curriculum development in Indonesia is more focused on the formation of all access for students accompanied by teaching materials that focus on self-development. The 21st century learning model also strongly emphasizes how students can think critically, are good at communicating, are able to collaborate and have high creativity or what is called 4C skills (critical thinking, communication, collaboration, and creativity). These skills are needed by learners in forming competencies to be able to face the challenges that are present in the Society 5.0 era (Indarta et al., 2022). One of them is creative thinking ability.

Creative thinking ability is the ability or thought process to provide new ideas that can be applied in problem solving (Munandar, 2009). Meanwhile, according to Talajan (2012) creativity is the ability to create something new (creative product) (Maghfiroh et al., 2016). According to Risnanosanti & Syofiana (2020) that creative thinking skills can be trained according to the learning material and it is also necessary to choose the right and effective learning model to be able to develop students' creative thinking skills (Risnanosanti et al., 2020).

According to Barus (2019), the learning model that teachers can choose for 21st century learning is Project Based Learning (Indarta et al., 2022). The Project Based Learning (PjBL) model is a learning model that focuses learning on projects or activities as its goal. In the process of implementing learning, Project Based Learning (PjBL) emphasizes the activities of students in finding information and then processing it into something that is beneficial to the lives of students and the lives of others, but still in accordance with the limits of the basic standards and competencies set by the curriculum at each level (Nugraha et al., 2018).

Project-based learning focuses on active learning where students explore authentic questions or tasks, develop plans, reflect on evaluating solutions, and produce multiple representations of ideas. Blumenfed positions Project Based Learning as a comprehensive instructional approach that can motivate children to think about what they are doing, not just focus on getting it (Smith, 2016).

According to Adinugraha (2018), one of the effective learning models to be applied at school is the Project Based Learning (PjBL) model which can improve learning outcomes, motivate and encourage students to be creative and independent in producing products, provide students with experience to build their own knowledge and improve students' ability to communicate products. In addition, according to Rini and Irwandi (2021) (Nita & Irwandi, 2021), learning with PjBL mode can improve students' creative thinking skills by providing systematic projects.

Based on the results of the researcher's interview with the biology subject teacher at Taman Mulia Private High School, Kubu Raya Regency, it was said that the creative thinking skills of students had not been fully trained and there was no special assessment of students' creative thinking skills. Biology subject teachers said that when delivering material, teachers usually often use conventional learning models with lecture methods that are assisted by projector tools, lks books, carrying out group discussions and group presentations at Taman Mulia Private High School also still using the 2013 curriculum. From this explanation, it turns out that the learning methods and models that teachers apply are quite varied but not optimal because they are still teacher-centered. During the learning process students also often feel sleepy, learning also feels boring. So that this affects the learning outcomes of students as well as the activity or response of students during the learning process in class.

With regard to this problem, the researcher is interested in conducting research on one of the alternative learning models, namely the Project Based Learning (PjBL) learning model through the making of bioplastic preserves on students' creative thinking skills with the research title "INFLUENCE OF PROJECT BASED LEARNING (PjBL) MAKING BIOPLASTIC PRESERVANTS ON THE CREATIVE THINKING ABILITY OF STUDENTS IN THE MATERIAL OF BIODIVERSITY ".

RESEARCH METHODS

This research uses experimental methods with the form of research used is a quasi-experiment (Quasy Experimental Design). By using two classes, namely the experimental class using the project-based learning model for making bioplastic preserves and

the control class using the discovery learning model Based on this form of experimentation, the design used is Nonequivalent Control Group Design. The research design can be seen in table 1.

Table 1. Nonequivalent Control Group Design

Group	*Pretest*	Treatment	*Posttest*
E	T_1	X_1	T_2
K	T_1	X_2	T_2

Description:
E : Experiment Class
K : Control Class
X1 : Experimental Class Treatment
X2 : Control Class Treatment
T_1 : Test awal (*pre-test*)
T_2 : Test akhri (*post-test*)

The population in this study were all students in class X of Taman Mulia Private High School in the 2023/2024 school year which is divided into four classes with a total of 100 students, namely, class X MIA 1 consists of 30 students, X IIS 1 consists of 23 students, X IIS 2 consists of 23 students, and X IIS 3 consists of 24 students.

The sampling technique used in this study is simple ranom sampling technique, namely taking sample members from a population that is carried out randomly without regard to the starta in the population. Data measurement was carried out twice before treatment (pretest), and after treatment (posttest). In addition, measurements were made by making direct observations with the help of observers to fill in the learning observer sheet. The data collection tools used are lesson plan implementation observation sheets and creative thinking essay test questions that have met the validity instrument test requirements. In addition, the learning tools used are lesson plans and LKPD. Learning tools and data collection tools were consulted with the supervisor and validated by three validators consisting of three FKIP lecturers at Muhammadiyah University of Pontianak and one biology teacher at Taman Mulia High School. The validity of an instrument can be known by using the Pearson Product Moment Correlation formula with the following formula:

$$Rxy = \frac{n\sum xy-(x)(y)}{\sqrt{\{n\sum x^2-(x)^2\}\{n\sum y^2-(\sum y)^2\}}}$$

Description:
rxy = Correlation coefficient between variables X and Y
n = Number of subjects or test participants
X = Score of each item
Y = Total scoreAdapun koefisien korelasi yang obtained is then interpreted into the following validity coefficient criteria (Sugiyono, 2010: 257) :

Table 2. Correlation Assessment Criteria

The value of r	Interpretation
0,00-0,199	Very Low
0,20-0,399	Low
0,40-0,599	Medium
0,60-0,799	Strong
0,80-1,000	Very Strong

Sumber: (Sugiyono, 2014: 184)

Because the test is in the form of an essay, the reliability of the test is calculated using Cronbach's Alpha. The reliability formula is as follows (Arikunto, 2013: 100):

$$r_{11} = (\frac{k}{k-1})\,(1 - \frac{\sum \sigma^2}{v_t^2})$$

Description:
r_{11} : instrument reliability
k : number of items or questions
$\sum \sigma^2$: number of item variants
v_t^2 : total variance
While the variance formula used to calculate reliability is as follows:

$$Vt = \frac{\sum x^2 \frac{(\sum x)^2}{N}}{N}$$

Description:
Vt : Question variance
$(\sum x)^2$: Square of the number of scores obtained by students
$\sum x^2$: The sum of the squares of the scores obtained by the students
N : Number of test takers

Tabel 3. Problem Reliability Coefficient Interval

Coefficient Interval	Relationship Level
0,800-1,000	Very High
0,600-0,779	High
0,400-0,599	Simply
0,200-0,399	Low
<0,200	Very Low

Sumber: (Arikunto, 2010:319)

After that, the level of difficulty of each item is carried out, using the following formula (Arikunto, 2015:225):

$$TK = \frac{\bar{X}}{SMI}$$

Description:
TK : Difficulty index
$\bar{X}$: Average value of each item
SMI : Ideal Maximum Score

Tabel 4. Criteria for Level of Difficulty

Interval	Criteria
0-0,30	Difficult category question
0,31-0,70	Medium category question
0,71-1,00	Easy category questions

Sumber: (Sudjana, 2013:137)

Furthermore, the differentiating power of the question is calculated using the following formula:

$$\mathrm{DP} = \frac{\bar{X}_A - \bar{X}_B}{SMI}$$

Description:
DP : Distinguishing Power
$\bar{X}_A$: Average score of the upper group
$\bar{X}_B$: Average score of the lower group
SMI : Ideal Maximum Score

Tabel 5. Distinguishing Power Interpretation Criteria

Distinguishing Power Index	Description
0,00-0,20	Bad
0,21-0,40	Simply
0,41-0,70	Good
0,71-1,00	Very Good

Sumber: (Arikunto, 2010:232)

The data analysis used in this study is to give scores on the pretest and posttest results of experimental and control class students.Converting scores to values with the following formula:

$$Rate : \frac{score\ obtained}{maximum\ score} \times 100$$

(Majid, 2014:343)

Determining the category of students' creative thinking ability based on the category of students' creative thinking ability can be seen in table 6.

Tabel 6. Interpretation of Students' Creative Thinking Level

Learner creativity score interval (%)	Interpretation of students' creative thinking skills
81 – 100	Very good
61 – 80	good
41 – 60	Simply
21 – 40	Less
0 - 20	Very Less

(Riduwan, 2010:41)

The measurement of the results obtained was analyzed using the gain value.

$$\text{Gain Score} = s_{posttest} - s_{pretest}$$

After the score is converted to a value, then next perform statistical analysis to determine the difference in the results of the experimental class and control class, through a prerequisite test with the Normality test is used to determine whether the data from the two samples is normally distributed or not. This study used the Shapiro-Wilk test with a significance level of 0.05. Followed by a variance homogeneity test. The homogeneity test aims to find out whether the experimental class and control class have the same variance or not. The homogeneity of veriances test was used and the data was not normally distributed. After that, it continued with the U-Mann Whitney test. Prerequisite tests were carried out using SPSS version 23.0. To calculate the effect of the project-based learning (PjBL) learning model on students' creative thinking skills, first average the gain value of experimental and control class students. Furthermore, the effect size is calculated using the following formula:

$$ES = \frac{\bar{X}_e - \bar{X}_c}{S_c}$$

Sumber : (Sutrisni, 2008:6)

Description:
ES : *Effect size*
$\bar{X}_e$: Average experimental class score
$\bar{X}_c$: Average score of control class
S_c : Standard deviation of control class

To find out how much the interpretation of the results of the calculation of effect size (ES) can use Cohen's effect size interpretation criteria (1988: 3).

Tabel 7. Cohen's Effect Size Interpretation Criteria

Cohen's Standar	*Effect size*	*Percentile standing*	*Percent nonoverlap (%)*
Large	2.0	97.1	81.1
	1.9	97.1	79.4
	1.8	96.4	77.4
	1.7	95.5	75.4
	1.6	94.4	73.4
	1.5	93.3	70.7
	1.4	91.1	68.1
	1.3	90	65.3
	1.2	88	62.2
	1.1	86	58.9
	1.0	84	55.4
	0.9	82	51.6
	0.8	79	47.4
	0.7	76	43.0
	0.6	73	38.2
	0.5	69	38.2
Medium	0.4	66	27.4
	0.3	62	21.3
	0.2	58	14.7
Less	0.1	54	7.7
	0.0	50	0

RESULTS AND DISCUSSION

This research was conducted at Taman Mulia Private High School by taking two classes as samples, namely class X IIS 1 as an experimental class with treatment using a project-based learning model for making bioplastic preserves and class X IIS 2 as a control class with treatment using a discovery learning model. This research was conducted to see the differences in students' creative thinking skills on biodiversity material.

To find out the differences in students' creative thinking skills by using the project-based learning model, the prerequisite test is the normality test using the Shapiro-wilk test and the homogeneity test using the homogeneity of variances test which is then continued with the mann whitneny u test with the following results:

Tabel 8. Normality Test

Class	*Shapiro-wilk*		
	statistic	*Df*	*Sign.*
Pretset Eksperimen (PjBL)	0.933	23	0.127
Posttest Eksperimen (PjBL)	0.947	23	0.256
Pretset Control (DL)	0.962	23	0.508
Posttest Control (DL)	0.923	23	0.078

Based on table 4.4, it is known that the significance value of the pretest posttest of the experimental class and control class is greater than the significance value of 0.05 (0.127>0.05, 0.256>0.05, 0.508>0.05, 0.078>0.05) and it can be concluded that the data is normally distributed. Furthermore, the homogeneity test was carried out with the homogeneity of variances test with a significance level of 0.05 or 5%. The results of the homogeneity test in the experimental and control classes are as follows:

Tabel 9. Homogeneity Test Results

Results	**Test of Homogeneity of Variance**	
	Levene Statistic	**Sig.**
Based on Mean	11.937	.001
Based on Median	11.362	.002
Based on Median and with adjusted df	11.362	.002
Based on trimmed mean	11.612	.001

Based on the results of the homogeneity test in table 9. obtained a significance value of <0.05, the data is said to be inhomogeneous. Then the data analysis is continued using a non-parametric test using the mann whitney u test as follows:

Tabel 10. U Mann Whitney Test Results

Test Statistics[a]	
	Results of Creative Thinking Ability of Learners
Mann-Whitney U	88.500
Wilcoxon W	364.500
Z	-3.880
Asymp. Sig. (2-tailed)	.000

Based on the results of the mann whitney u test in table 10, the Asymp.sig value is obtained. (2-tailed) 0.000. if the Asymp.sig value. (2-tailed) <0.05 then the hypothesis is accepted while if the Asymp.sig value. (2-tailed) > 0.05 then the hypothesis is rejected. Based on what is obtained in the table above the Asymp.sig value. (2-tailed) 0.000 <0.05 and the hypothesis is accepted. Thus it can be said that there is a difference in the creative thinking ability of students between the experimental class (project-based learning) and the control class (discovery learning). Because of the significant difference, it can be said that there is an effect of using a project-based learning model for making bioplastic preserves on students' creative thinking skills. The results of the research data obtained from the experimental and control classes are as follows:

Tabel 11. Average Score of Creative Thinking Ability of PjBL Class and DL Class

Treatment	Pretest		Posttest		Gain
	Average	Category	Average	Category	
PjBL	31,63	Less	78,91	Good	47.28
DL	27,39	Less	60,76	Simply	33.37

Based on table 11, it can be seen that the ability to think creatively of students from pretest to posttest has increased in both PjBL and DL classes. Both classes have less creative thinking categories in the pretest while in the posttest results have different creative thinking categories, namely, the PjBL learning model class is a good category with an average value of 78.91 and the DL learning model class is a sufficient category with an average value of 60.76. Based on the experimental class group gain value of 47.28, it is quite high when compared to the control class group gain value of 33.37. The data shows that learning using project-based learning model is higher than learning using discovery learning model. The results showed that the average value of the experimental class pretest was 31.63 and the control class was 27.39, while the average value of the experimental class posttest was 78.91 and the control class was 60.76 and it can be seen that the creative thinking ability of students from pretest to posttest has increased in both experimental and control classes. Both classes have less creative thinking categories in the pretest while in the posttest results have different creative thinking categories, namely the project-based learning model class in the good category and the discovery learning model class in the sufficient category. Based on the gain value of the experimental class group, 47.28, it is quite high when compared to the gain value of the control class group, 33.37. The data shows that learning using the project-based learning model is higher than learning using the discovery learning model.

Tabel 12. Percentage of Creative Thinking Ability of PjBL and DL Class Students

Indicator	Eksperimen Class PjBL		Control Class DL	
	Total number of students	Percentage (%)	Total number of students	Percentage (%)
High	14	60,86	4	17,39
Medium	7	30,43	3	13,04
Low	2	8,69	16	69,56

Based on table 12, it can be seen that the creative thinking ability of students varies, namely, high, medium, and low. While the creative thinking ability of students per indicator can be seen in table 13.

Tabel 13. Categories of Creative Thinking Ability per Indicator of Experimental Class and Control Class

Creative Thinking Indicators	Eksperimen Class PjBL		Control Class DL	
	Score	Category	Score	Category
Fluency	94,92	Very Good	72,82	Good
Flexibility	77,89	Good	65,21	Good
Originality	66,30	Good	47,28	Simply
Elaboration	69,02	Good	49,45	Simply

Based on table 13, it can be seen that the creative thinking ability of students per indicator. Of the four indicators, the highest value is the fluency indicator (fleuncy) which is 94.92 in the experimental class and 72.82 in the control class. Based on the results of the normality test, it is known that the data from the pretest results of the experimental class and the control class are normally distributed. This shows that there is an average difference in the pretest results of experimental and control class students and it can be said that the initial creative thinking ability of students is the same. In the study after the pretest to determine the ability of students, the learning process was carried out. In the experimental class, learning was carried out using a project-based learning model by making bioplastic preserves while the control class used a discovery learning model. Furthermore, a posttest was conducted in the experimental class and in the control class to determine the creative thinking ability of students on biodiversity material. The experimental class

had an average posttest score of 78.91 and an average control class posttest score of 60.76. The average posttest value of the experimental class is quite large than the control class, it shows that the creative thinking ability of students in the experimental class using the project-based learning model for making bioplastic preserves is quite high compared to the class using the discovery learning model.

Based on calculations using effect size, a value of 1.16 is obtained which is included in the large category. This shows that the results of the creative thinking ability of students between class X IIS 1 who use the project-based learning model for making bioplastic preserves are debatable with class X IIS 2 students who use the discovery learning model. This also shows the influence of the project-based learning model through making bioplastic preserves occurs because the project-based learning model can facilitate students to train creative thinking skills by giving systematic project assignments. In this research, the project-based learning model makes bioplastic preserves of plants around the environment that can represent examples of the three levels of biodiversity. The project-based learning model is structured by providing authentic questions that are presented in the LKPD. This makes a related picture of the project that will be carried out by students.

CONCLUSION

Based on the results of the research that has been done, it can be concluded that the application of the Project Based Learning model of making bioplastic preserves to the creative thinking skills of students in biodiversity material has a significant effect on improving the creative thinking skills of students in biodiversity material. This is based on the hypothesis that has been obtained that there is an average difference between the experimental class and the control class in the essay question test. In the calculation of effect size, a value of 1.16 is obtained with a percent nonoverlap of 58.9% which is included in the large category, therefore the effect of the project-based learning model for making bioplastic preserves on the creative thinking ability of students in biodiversity material is included in the large category.

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