Creative thinking: The Effect of Green School-Based Project Based Learning (PjBL) Model

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Abstract. This study aims to determine the effect of the application of the Green School-based Project Based Learning (PjBL) learning model on students' creative thinking abilities in waste management at schools using environmental pollution material at SMA Negeri 9 Bandar Lampung. This study uses the Quasy Experiment method. Data collection techniques in this study were in the form of tests, observations, and documentation. The results obtained in this study are that the Green School-based Project Based Learning (PjBL) learning model influences the creative thinking abilities of students at SMA Negeri 9 Bandar Lampung with environmental pollution material. This is indicated by the Sig value obtained in the hypothesis test which is 0.00 or ≤ 0.05.

1 Introduction

Creative thinking can be defined as the process used to generate new ideas or ideas. New ideas can come from the incorporation (elaboration) of old ideas or ideas that have just emerged. According to Widowati [1], Creative thinking is readily accomplished in a learning environment that directly allows pupils to think honestly and flexibly without fear or guilt. Creative thinking aims to foster students' abilities and responsibilities in overcoming future challenges [2]. In determining creative thinking there are several indicators. The following are indicators of creative thinking according to Putra et al. [3], Specifically, they include flexibility, inventiveness, and elaboration. Using the PjBL learning paradigm can help you develop your creative thinking skills.

Model-based learning is learning that follows the stages of teaching. Project Based Learning (PjBL) is a model that has the potential to increase student creativity [4]. According to Belagra & Draoui PjBL is a pedagogical approach that allows all students to be fully involved in project learning and interact with peers [5]. According to Anita et al., PjBL learning will involve students in learning activities in addressing challenges and giving pupils opportunity to think creatively [6]. PjBL has 6 syntax, namely project determination, planning rules for working on projects, making project schedules, monitoring project progress, assessing project results and evaluating student experience [5]. According to

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Jauhariyyah et al. project-based learning has several characteristics, namely learners make decisions about a framework, the existence of challenges, design processes, are collaborative, manage information and are very tolerant of errors [7]. PjBL is a model that is very suitable for use in learning that directly interacts with the environment if applied in biology learning.

The environment is where all organisms on Earth dwell, particularly humans. When someone thinks about the environment, what normally comes to mind is items or anything surrounding humans [7]. Environmental sustainability is a process or means of protection from destruction and damage. The arrangement of natural resources that ensure their sustainable use of their savings still improves the quality of their diversity value and still maintains them [5]. Green School is a curriculum of programs to integrate environmental values into school activities [8]. According to Lidia, green school activities can improve the character of caring for the environment from an early age [9]. Meanwhile, according to Kristiawan character education caring for the environment in Green School runs well, it can be seen that students are responsible and caring in preserving the environment [10]. Although the application of green school is in the good category, if the participation of students is not trained until the stage of forming environmentally friendly products, the thinking pattern is still not good, so project-based teaching is needed which is expected to foster attitudes and mindsets that love the environment [11].

The critical thinking skills of Indonesian pupils remain comparatively low. Based on a four-year study using questions that assess students' critical thinking abilities and high cognitive level, the International Trends in International Mathematics and Science Study (TIMSS) reveals that Indonesian students routinely rank 64th out of 65 countries with an average score of 375, while the global average is 500. The TIMSS research included non-routine issues to gauge higher-order thinking abilities in its questions. Facing these problems, students are required to think critically and creatively [12].

Environmental issues may be resolved by creative thinking, leading to solutions that protect the environment. Based on research conducted by Wahyuni & Rahayu it was found that PjBL can train creative thinking skills on growth and development materials [13]. Meanwhile, according to Fitrianingsih Students may get practical learning experiences through the project-based learning paradigm, which will help them develop their creative thinking and generate engaging products [14]. In research conducted by Pramashela et al., it has been discovered that project-based learning techniques can foster students' capacity for original thought [15]. From some of the literature above regarding the influence of PjBL on the level of creative thinking of students, there has been no research based on Green school. And with the fact that SMA Negeri 9 Bandar Lampung has stated that the school is a Green School, it is necessary to conduct research that aims to observe the impact of the PjBL learning approach, which is founded in Green Schools, on the innovative thinking of SMA Negeri 9 Bandar Lampung pupils.

2 Methods

This study used a posttest-only control design and two classes as samples: class X.8 serves as the experimental class and class X.10 serves as the control class. The research was carried out at SMA Negeri 9 Bandar Lampung starting from April 10 to May 15, which was for three weeks of learning period, this research used projects in the form of hydroponics and biopore holes. The present study included data gathering procedures such as testing, documentation, and observation.

The instrument in this study is in the form of posttest questions. The posttest questions in this study aim to describe and analyze the influence of student learning models. Documentation is used to document activities in the form of photographs. And for observation it is used to measure the creative level of students. Prerequisite exams and data analysis methods were employed in this study. Validity tests, reliability tests, difficulty
testing, and data analysis methods utilizing homogeneity, normality, and hypothesis tests are the essential tests in this study.

3 Result and Discussion

3.1 The Influence of Learning Models on Students' Creative Thinking

The t-independent test was used in this investigation to assess the hypothesis. Table 1 displays the findings of the experimental class's t-independent test computation.

<table>
<thead>
<tr>
<th>Class Type</th>
<th>t-test for Equality of Means</th>
<th>Sig. Value</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Difference</td>
<td>Std. Error Difference</td>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td>Class</td>
<td>9.474</td>
<td>1.763</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Based on Table 1, a hypothesis test was obtained to have a Sig value of 0.00 or < of 0.05. This indicates that the direct instruction learning model and the PjBL learning model based in Green Schools have an impact on the creative thinking of SMA Negeri 9 Bandar Lampung's grade X students. The results of research by Phelia et al. (2021) show that PjBL learning requires every student to participate in completing projects, thus triggering students to think creatively. Table 2 displays the findings of a study on students' creative thinking when employing the PjBL learning model and direct teaching.

<table>
<thead>
<tr>
<th>No</th>
<th>Kelas</th>
<th>Observation Sheet Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Max</td>
</tr>
<tr>
<td>1</td>
<td>Experimental Class (PjBL)</td>
<td>71.66</td>
</tr>
<tr>
<td>2</td>
<td>Control Class (Direct Instruction)</td>
<td>36.66</td>
</tr>
</tbody>
</table>

3.2 Level of Creative Thinking Ability

To obtain data on the level of creative thinking ability, researchers use observation sheets. The resulting data can be seen in figure 1.
A graph of the students in the experimental and control groups' capacity for creative thought is shown in Figure 1. The number 1 represents the experimental class, whereas the number 2 represents the control class. The graph indicates that pupils in the experimental class thought more creatively than other students.

The purpose of this study is to ascertain how students' capacity for creative thought in waste management at school utilizing environmental pollution materials is impacted by the use of the PjBL learning model, which is based in Green Schools. The research hypothesis in this study was tested using a t-independent hypothesis test. The generated findings have a significance level of 0.00 or less than 0.05. Based on the test findings, it is known that students' creative thinking is impacted by the accepted hypothesis or the PjBL learning model implemented in green schools.

According to Saputro & Rayahub, the PjBL learning model has the advantage of encouraging students to work actively, collaboratively, and providing opportunities for students to think creatively [16]. This is reinforced by research conducted by Yunita et al. which shows that the When comparing experimental class pupils with high categories to control classes, the PjBL learning model can help them with their creative thinking skills [17]. PjBL learning models produce superior student learning results than non-PjBL ones.

The experimental class utilizing the PjBL learning model has an average score of 68.28%, whereas the control class using the direct instrument learning model has an average score of 32.28%, according to Table 2. It is evident from the statistics in the above table that the experimental class thinks more creatively than the other classes. This is relevant to the results of research conducted by Astuti et al., that project-based learning has a big impact on developing creative thinking abilities [18].

The capacity for original thought based on signs in the experimental class and control class is seen in figure 1. The experimental class scored 61% in the first indication, new ideas, whereas the control class only received a 26%. The experimental class received a score of 63% in the second indication, which is different materials, whereas the control class had a number of 39%. Regarding the third metric, which is distinct product designs, the experimental group had a score of 66%, whereas the control group received a value of 27%. The product is more enticing, as evidenced by the fourth indication, which gives the experimental class a value of 75% and the control class a value of 34%. In terms of idea assessment, the experimental class received a score of 79%, while the control group received a score of 35%.

Based on these data, it is known that the experimental class has a level of creative thinking by looking at indicators of creative thinking higher than the control class. In research conducted by Yamin et al., the peer assessment indicators were achieved at an 87% rate, whereas product inventiveness indicators were achieved at an 88% rate [19-20]. Therefore, it can be said that non-science students can benefit from project-based integrated science learning by developing their capacity for creative thought.

This research used the PjBL model with hydroponic projects and biopore holes. Researchers carry out 6 syntaxes in the PjBL model, namely project determination, planning project rules, making project schedules, monitoring project development, assessing project results and evaluating student learning experiences. This agrees with Rezeki et al. and Handayani that the project-based learning process has the potential to build student activity so that creativity arises in students [21-22]. Here are the results of student projects.
The aim of this research is to ascertain how the Project Based Learning (PjBL) learning paradigm, which is used in Green schools, affects the creative thinking of students at SMA Negeri 9 Bandar Lampung. This green school concept helps to preserve the environment, as well as teach students to love nature and manage the environment. The importance of instilling a love for the environment from an early age is because the longer our earth ages, the older we are and the ability of the earth to human behavior is getting smaller. In addition, damage occurs on earth will also increase so as to minimize habitable places for humans [23].

The implementation of Green schools will create an environmental greening movement in schools [24]. So as to grow students with a sense of responsibility and a sense of wanting to protect the environment. Based on research conducted by McCullough et al., that learning directly interacts with the natural environment can improve learning with student attention and behavior [25].

The results of data analysis using quantitative methods of this study prove that the green school-based PjBL learning model affects the level of creative thinking of students. This is supported by Wu & Wu research that the PjBL model is effective for students' creative ability to express ideas and solve problems regarding the environment [26]. PjBL based on this green school not only increases creative thinking but also fosters a love of the environment for students [27].

References

15. Fitrianingsih Mokambu, 56 (2021)