JAMBURA GEO EDUCATION JOURNAL
P-ISSN: 2721-7000 | E-ISSN: 2721-7019
Volume 4 Number 2, September 2023, 179-186
Journal Homepage: http://ejurnal.ung.ac.id/index.php/jgej

Effectiveness of Problem Based Learning Model on Creative Thinking in Senior High School

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ARTICLE INFO

Article History:
Received: 2023-08-25
Accepted: 2023-09-26
Published: 2023-09-30

Keywords:
Collaboration; Cooperative; Innovation; Pedagogy

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Email:mochriopambudi@ung.ac.id
DOI: 10.34312/jgej.v4i2.21806

ABSTRACT

In Indonesia, research show inadequacy in creative thinking skills among students with only about 2% being proficient in tackling problems of moderate to high difficulty according to TIMSS research. At SMA Negeri 1 Papar, the challenge of low creative thinking skills of students is evident in test results with an average daily test score of 70 reflecting this concern. Nonetheless, the latent potential to develop creative thinking skills exists within Indonesian students, thus the need to encourage teachers to use appropriate educational strategies. To that end, the Problem-Based Learning (PBL) model emerged as an appropriate solution to address the shortcomings in students' creative thinking skills. However, little knowledge is available in this important area. This research focuses on assessing the impact of the PBL model on students' creative thinking skills by using a quasi-experimental methodology. The experiment involved students in class XI-IIS 1 (36 students) as the experimental class and XI-IIS 3 (34 students) as the control class in the even semester of the 2022/2023 academic year at SMA Negeri 1 Papar. Using essay questions as an assessment tool, the data were analyzed using SPSS 23 for Windows through a t-test, with a significance level of 0.05. In particular, a considerable difference was observed between the experimental group using the PBL model and the control group using the conventional approach. The results of the hypothesis test showed a significance level of 0.000, underscoring the potential of the PBL model in fostering higher creative thinking ability among students, as evidenced by its striking difference with a significance threshold of 0.05. The findings are useful to Educators, teachers, parents and students. The study recommended that PBL can be adopted and used to teach in all subject areas in the curricula in order to help develop the creative thinking skills of students.

How cite: Sari, M. I., Pambudi, M. R., Gudu, B. O., &Tholibon, D. A. (2023). Effectiveness of Problem Based Learning Model on Creative Thinking in Senior High School. *Jambura Geo Education Journal*, 4(2), 179–186. https://doi.org/10.34312/jgej.v4i2.21806

1. Introduction

In the dynamic landscape of the 21st century, individuals must equip themselves with a spectrum of aptitudes that resonate with contemporary demands worldwide. Striking a balance between technical proficiencies and interpersonal acumen is pivotal for achieving a competitive edge. The skill set imperative in this era encompasses innovation and creativity, adept problem-solving and critical thinking, seamless collaboration, effective communication, and a spirit of entrepreneurship (Dilekçi&Karatay, 2023;Redhana, 2019). In light of these imperatives, it is irrefutable that the 21st-century individual's toolkit must encompass the capacity to engage in critical thought, articulate ideas convincingly, foster teamwork, and drive innovation, as these competencies lay the foundation for enduring success. However, It is not known the educational strategies that teachers adopt to develop these creative skills in students in SMA Negeri 1 Papar, Indonesia.

In addition, creative thinking skills play a pivotal role in enhancing student accomplishments. Research reports indicate that students endowed with exceptional creative thinking skills often attain more favorable learning results than those students lacking the creative thinking skills. Scholarly investigations conducted by experts have definitively established that the manifestation of robust creative thinking skills in students correlates with heightened levels of intelligence (Hews et al., 2023;Zhuang et al., 2021). Thus, a logical deduction can be drawn that students who possess commendable creative thinking skills also exhibit a proclivity for achieving superior educational accomplishments. This underscores the profound impact of fostering creative thinking as a fundamental aspect of holistic learning. However, no research has been undertaken to identify the students with high creative skills in Indonesian context.

Moreover, researchers report that there is a problem of inadequate creative thinking skills of students' in Indonesia. This finding is revealed through various surveys that have been conducted to measure its quality.

For example, results from the TIMSS study showed that only about 2% of students were able to solve problems with medium to high difficulty levels. In addition, survey results from PISA also indicated that the creative thinking skills of Indonesian students ranked 64th out of a total of 65 countries assessed in the study (Pambudi, 2021). Based on these findings, it can be concluded that the level of creative thinking skills in Indonesia is still relatively low. Therefore, solutive steps need to be taken to overcome this problem.

Besides, creative thinking flourishes as students engage in the process of problem-solving, a journey that prompts them to synthesize an array of knowledge into novel insights, spurred by their own personal experiences. This honed creative thinking acumen empowers students to navigate diverse scholastic endeavors (Yildiz&GulerYildiz, 2021).Notably, creative thinking bestows a range of advantages upon students, spanning from heightened intellectual prowess to adept task accomplishment, and from forging pathways to explore alternative resolutions in the face of challenges (Ruqoyyah et al., 2020). The symbiotic relationship between problem-solving and creative thinking is emblematic of how the latter is harnessed as a cognitive tool within the former, fostering holistic skills essential for academic and real-world success (Elizabeth et al., 2018). However, it is not known the advantages that students of SMA Negeri 1 Papar gained as a result of engaging in problem solving activities during lessons.

Further, the problem of low creative thinking skills of students was identified at SMA Negeri 1 Papar. This problem was revealed based on the results of students' daily tests. This data relates to student achievement in disaster mitigation material, which gets an average score of 70. The question indicators in the daily test are designed to measure creative thinking skills, with the difficulty level reaching high order thinking. In this context, the average score obtained illustrates that students' creative thinking is low (Ruqoyyah et al., 2020). This decline is likely caused by students' limitations in connecting geosphere phenomena with the spatial conditions found in the environment around them.

However, given the intricate challenges elucidated earlier, the Problem-Based Learning (PBL) paradigm emerges as the most fitting remedy to surmount the dearth of creative thinking abilities among students. Encompassed within the PBL framework is the prospect of enhancing creative thinking proficiencies, empowering students to deftly address and resolve an array of contextually embedded quandaries (Pambudi&Masruroh, 2023;Servant-Miklos, 2019). It follows, therefore, that the PBL model stands as an apt recourse for addressing the predicaments entailed in bolstering students' creative thinking aptitude. By harnessing the tenets of PBL, educators can effectively nurture a generation of agile thinkers, primed to embrace and surmount the dynamic challenges of our modern world. These skills need to be developed in learners by teachers in all areas of learning in the curricula.

Further, in the implementation of the Problem-Based Learning (PBL) instructional framework, students assume a proactive role in comprehending and devising remedies for the challenges at hand. They collaborate within groups or teams to facilitate dialogues, conduct inquiries, and formulate strategic approaches to fulfill their assignments. This procedural dynamic not only fosters a deeper level of engagement but also imbues learning with context that resonates meaningfully and tangibly with their surroundings (Phungsuk et al., 2017). Consequently, the knowledge assimilated takes on an inherently practical quality, rendering it readily applicable to the gamut of real-life scenarios that unfold in their daily routines (Andersen &Rösiö, 2021).

Also, the PBL learning model is an approach that brings up a number of advantages and benefits that are very suitable to be implemented in the educational process for students. The advantages and benefits of the PBL model are as follows: First, the PBL model has the capacity to foster students' interest in learning effectively. Second, this model stimulates students to hone their creative or advanced thinking skills. Third, PBL encourages the development of students' metacognitive capacity optimally. Finally, the PBL model presents a meaningful learning experience, thus encouraging students to develop strong self-confidence and independent learning abilities. The PBL model has been proven effective in training students to engage themselves in the creative thinking process (Mamusung et al., 2023;Mayasari et al., 2022). By following the right steps in implementing PBL, the learning process can be carried out efficiently and successfully achieve its goals. However, it is not known the challenges teachers realized as they implemented the PBL model in the lessons since their learners lack creative thinking skills.

Last but not least, in the context of this study, our literature review showed that most of the previous research was on solving students' creative thinking problems. However, we identified a gap in the literature covering the use of learning models. Previous research tends to use learning models that use cooperative learning approaches that emphasize group work such as the TGT learning model. Previous research conducted by MasraLatjompoh showed that students' creative thinking skills with the TGT model were still in the moderate category (Latjompoh et al., 2021). Therefore, our research aims to fill this gap by investigating students' creative thinking skills using a scientific approach with a PBL learning model.

2. Methods

In this study, researchers used a quasi-experimental method. The design used in this research is posttest-only control group design. This study examines 2 variables, namely the independent variable PBL learning model and the dependent variable, namely creative thinking. The research samples were students of class XI-IIS 1 as an experimental group totaling 36 people and class XI-IIS 3 as a control group totaling 34 people. This research was conducted in the even semester of the 2022/2023 academic year, with a concentration on disaster mitigation subjects, at SMA Negeri 1 Papar. This careful organization of the research design and sample size ensures the robustness and reliability of the resulting analysis results.

Table 1. Research Design

Group	Treatment	Measurement
Experiment	PBL model treatment	Posttest
Control	-	Posttest

The PBL learning model has a number of stages that are implemented to develop students' creative thinking skills in the context of geography learning. The initial stage is called problem orientation, which aims to train problem formulation skills. Then, the second stage involves the organization of students in research activities, aiming to develop the ability to formulate problems and provide views. The third stage, group investigation supervision, is applied to train students in providing views, deductive and inductive logic. The next stage, the presentation of research results, is designed to develop evaluative skills. Finally, the fifth stage, which includes analysis and evaluation, is used to hone decision-making and implementation skills in solving problems (Mayasari et al., 2022).

This study uses primary data obtained through research at SMA Negeri 1 Papar, involving subjects from two classes, namely classes XI-IIS 1 and XI-IIS 3. learning materials used in experimental classes and control classes are disaster mitigation Data collection in this study was carried out by measuring the value of students' creative thinking skills. The instrument used in this research is an essay question. There are four statements of essay questions that are applied to measure aspects of students' creative thinking skills.

Table 2. Creative Thinking Ability Indicator

Indicator	**Description**
Flexibility	The ability to produce ideas fluently and variously that are relevant
Fluency	The ability to adapt and switch between different approaches to thinking
Originality	The ability to provide answers that are unusual and distinctive compared to common thinking
Elaboration	The ability to develop and expand existing ideas

The scoring process for students' creative thinking ability posttests was carried out with the following formula (1):

$$\text{Student Score} = \frac{\text{Total Score}}{\text{Maximum Score}} \times 100 \quad (1)$$

Based on the above formula, data on the achievement of students' creative thinking skills will be obtained. Then the data is categorized through determining the level of success of the action which can be seen in Table 3.

Table 3. Qualification of Creative Thinking Ability

Value	**Qualification**
86-100	Very good
71-85	Good
56-70	Simply
41-55	Less
<40	Very Less

All collected creative thinking ability data were analyzed using t-test through SPSS version 23 for Windows software. Hypothesis testing decisions were made by considering a significance level of 0.05.

3. Results and Discussion

Data presentation is based on creative thinking metrics, where the outcomes of the learning are summarized through quantification of the scores obtained in the experimental group. This analytical approach allows for a comprehensive evaluation of the impact of the learning intervention on students' creative thinking skills, providing a quantifiable foundation to explain the effectiveness of the instructional effort. Using a well-defined creative thinking proficiency scale, this approach is aligned with the objective of measuring the extent to which the learning experience has enriched students' cognitive acuity.

Table 4. Distribution of Creative Thinking Ability Score of Experimental Group

Value	Qualification	Frequency	Percentage
86-100	Very good	17	47
71-85	Good	19	53
56-70	Simply	0	0
41-55	Less	0	0
<40	Very Less	0	0
Total		36	100

The table 4 reflects that more than half of the entire student population, as many as 17 students or around 47%, belong to the good creative thinking ability category. A total of 19 students or about 53% showed a very good creative thinking ability score. There are no students who fall into the moderate to very less category in terms of creative thinking ability, covering a percentage of 0%. The presentation of data is based on a creative thinking ability scale, with learning outcomes represented in the form of scores obtained from the control group.

Data delineation relies on a creative thinking scale, where the culmination of educational achievement is realized through quantification of the scores obtained from the control group. This approach is used to holistically evaluate the impact of an instructional intervention on students' creative thinking ability in a defined context. Using a carefully designed creative thinking rating scale, this method aims to provide a comprehensive insight into the extent to which the pedagogical approach has enriched students' cognitive capacities. Moreover, the reliance on scores from the control group ensures accurate comparative analysis, allowing for a deeper understanding of the differential effects of instructional strategies.

Table 5. Control Group Creative Thinking Ability Score Distribution

Value	Qualification	Frequency	Percentage
86-100	Very good	1	3
71-85	Good	12	35
56-70	Simply	13	38
41-55	Less	8	24
<40	Very Less	0	0
Total		34	100

The data (table 5) in the table revealed that there were 13 students or 38% of the total student population who scored from very good to fair in terms of creative thinking skills. On the other hand, 8 students or 24% of the student population showed scores from less to very less in terms of creative thinking ability. This information gives an idea of the distribution of creative thinking skills scores among students and indicates the variation that exists in the achievement of these skills.

The results of the hypothesis analysis (table 6) indicated that there was a variation in creative thinking ability among students, which seemed to emerge between the experimental and control classes. Furthermore, the hypothesis test results showed a significance value of 0.000, which is much smaller than the predetermined significance level of 0.05. This indicates that the observed difference in creative thinking ability between the experimental and control classes is not the result of chance, but has strong statistical significance.

Table 6. Hypothesis Test Results

Class	N	Mean	Sig.
Experiment	36	84	0,000
Control	34	64	

The results of hypothesis testing and the average values that have been obtained are explained in Table 3. From the data, it can be seen that the average creative thinking ability in the experimental group, which applied the PBL model, reached 84. This shows a significant increase when compared to the average value of learning outcomes in the control group, which was recorded at 64. This result illustrates that the group of students who were taught using the PBL model approach achieved a higher average score in creative thinking abilities. This indicates that the PBL model has a positive impact in significantly improving students' creative thinking skills.

The results of this study indicate that the use of PBL model has a positive impact on students' creative thinking ability. After participating in learning with PBL model, students experienced significant improvement in their thinking abilities, in contrast with students taught using conventional learning. This opinion is in line with the views of Mohammed Abdullatif Almulla, the results revealed that the use of PBL techniques increased the level of student participation by giving them the opportunity to share knowledge, information, and discuss together (Almulla, 2020). Students' creativity is stimulated by their ability to directly observe events in the field and analyze phenomena that occurs in real-time.

In the context of our findings, the results of our study show that the use of PBL models significantly increased students' creative thinking skills in the learning process. These results are consistent with research conducted by Halimah DwiCahyani, who also found that the use of PBL learning models can improve students' creative thinking and critical thinking skills (Cahyani et al., 2021). In addition, our findings support similar findings by Elsa Putri Pebriyani, who found that the learning process using the PBL model students become active so as to improve their critical thinking skills and learning outcomes (Pebriyani&Pahlevi, 2020).

Besides, the utilization of a well-implemented PBL model has a close relevance to disaster mitigation materials. In the context of disaster mitigation, the application of the PBL model can be an effective means of developing students' creative thinking skills. The PBL process directs students to respond to real problems related to disasters and find innovative solutions. The problem orientation stage in PBL, where students formulate problems and develop a variety of ideas, is similar to the analytic approach in creative thinking that is relevant in disaster mitigation. Through interaction with contextualized problem situations, students not only understand the importance of mitigation measures, but also develop flexible thinking skills and a deep understanding of the impacts and ways to reduce disaster risks. Contextual learning approaches that interest students also facilitate understanding without the need to memorize information (Kang & Lee, 2023). Through the application of the PBL model with real problem situations, it is proven to increase students' understanding, knowledge, and skills in problem solving (Hendra et al., 2021). Overall, the PBL model can be an effective tool in providing students with a foundation to hone creative thinking skills relevant to disaster mitigation materials.

The second syntax, which relates to student organization, plays a role in facilitating interaction, discussion, and the contribution of new ideas. It significantly advances the flexibility, elaboration, as well as originality aspects of thinking. Through this process, students hone their creativity and production skills. Problem-based learning models play an important role in developing higher-order thinking skills among diverse groups. Research states unequivocally that PBL has a positive impact on the development of students' creative thinking skills, stimulates engagement and attention in the learning process, and encourages productive cooperation within a group framework (Liu &Pásztor, 2022). From a constructivism perspective, it is asserted that learning that encourages student independence contributes to better knowledge retention. The PBL model is proven to be effective in improving creative thinking, problem-solving skills, and mastery of core knowledge. Furthermore, PBL stimulates factors such as creativity, initiative, motivation in learning and skills in overcoming collaborative challenges (Azizah, 2022).

The third syntax seeks to encourage independent inquiry, where students are directed to gather relevant information for understanding and problem solving. This stage allows for the contribution of original ideas in an effort to find solutions to problems, which in turn develops flexibility, originality and flexibility of thinking. The learning process involves activities such as observation, online information searches and individual tasks. Through a problem-based learning approach, progress is made in strengthening creative thinking skills through developing context-relevant solutions, bridging real-life experiences with the learning process. Problem Based Learning (PBL) exercises analysis of real-life problems (Makur et al., 2023;Meneses et al., 2023). In the context of disaster mitigation, this approach allows students to actively seek disaster-related information, formulate innovative solutions, and apply knowledge in real disaster situations. The framework of daily life context used in this approach plays a role in enriching the meaning of the learning process, while empowering students' thinking skills.

The fourth syntax in the learning model involving deliverables is closely related to disaster mitigation materials. In the context of disaster mitigation, student involvement in the planning, preparation and presentation of disaster-related reports has important implications. This process not only encourages collective participation that enriches ideas through feedback from classmates, but also develops elaboration skills and flexibility of thinking in formulating disaster mitigation solutions. With active learning approaches such as PBL, the development of critical and creative thinking aspects is enhanced, which becomes a strong foundation for building sustainable and applicable understanding (Segundo-Marcos et al., 2023). The PBL model provides opportunities for deep understanding through problem solving, shaping attitudes and competencies appropriate for dealing with disasters. Through collaboration in discussions, understanding of geography concepts is deepened, potentially leading to the development of more effective disaster mitigation strategies. The PBL approach stimulates communication, cooperation, activity, problem solving and aspects of student character. Creative thinking skills applied within this framework enable the discovery of new facts, concepts and theories that support a deeper understanding of disaster mitigation.

The fifth syntax involving the process of analysis and evaluation in dealing with problems has a strong connection with disaster mitigation materials. In the context of disaster mitigation, students' ability to analyze and evaluate proposed mitigation solutions is critical. This evaluation process not only helps the development of elaboration skills and fluency of thinking, but also corresponds to the steps taken in the PBL model at the solution analysis and evaluation stage. At this stage, students are involved in analyzing the various mitigation strategies that have been tested, drawing conclusions based on available evidence and explanations, and elaborating on the results of their analysis. This step is a meaningful and important learning achievement in the PBL approach (Silviariza&Handoyo, 2020;Ssemugenyi& Hung, 2023). In a learning environment that integrates disaster mitigation materials, the analysis and evaluation stage in PBL teaches students how to identify the most effective solutions to reduce the impact of natural and human disasters and evaluate their effectiveness.

The implementation of the PBL model has a very significant positive impact on the dynamics of learning. This is evident from the much higher level of enthusiasm, spirit and engagement of students, both inside and outside the classroom. The PBL approach also stimulated an increase in the level of student participation, which in turn encouraged progress in the development of creative and critical thinking skills. Therefore, with this range of evidence, it can be confidently concluded that the PBL approach has a very real influence in improving the overall effectiveness of the teaching-learning process (Kanyesigye et al., 2022). In order to meet the challenges of modern education, the PBL model proves to be an effective instrument for building students' enthusiasm for learning, encouraging active participation, as well as honing the intellectual skills needed to cope with the complexities of the real world.

5. Conclusions

Based on the results of hypothesis analysis, where the significance level reaches 0.000 which is lower than the threshold value of 0.05, conclusions can be drawn. This study makes it possible to state that the application of the PBL model has an impact on student learning outcomes. Through the PBL model, students are encouraged to understand the material deeply and face complex challenges that require creative thinking. The positive results in improving the ability to connect ideas, formulate innovative solutions, and collaborate show that PBL is an effective tool to nurture creative thinking. Referring to the conclusion of this study, the author would like to propose some recommendations that can be given to teachers and researchers in this context. For teachers, it is recommended that PBL can be adopted and used to teach in all subject areas in the curricula in order to help develop the creative thinking skills of students. However, teachers should pay attention to the following: a) arrange the right time allocation to apply the PBL model, and b) have a deep understanding of the advantages and disadvantages that may arise in the application of the PBL model. As for other researchers who are interested in continuing this research, it is recommended to examine the impact of PBL learning models on other variables, such as geographical location, education level, or even different subject matter. Thus, it will create a broader foundation for the understanding and development of this learning method.

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