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A Meta-Analysis of the Problem-Based Learning Model to Enhance Students' Creative Thinking Skills

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Abstract

This study aims to investigate the influence of the Problem Based Learning (PBL) model on enhancing students' creative thinking skills. Meta-analysis method was employed to collect and analyze data from 17 relevant articles published in online journals between 2018 and 2023. The analysis results indicate that the implementation of the PBL model has a significant impact on enhancing students' creative thinking skills, with an effect size value of 0.40 categorized as a moderate effect. The implications of these findings underscore the importance of integrating the PBL model into educational approaches to facilitate the development of students' creative thinking skills in various educational contexts.

A. Introduction

In facing the ever-evolving era of globalization, it is crucial for Human Resources (HR) to continually innovate and develop [1]. One effective approach is to enhance the quality of education, as education serves as the cornerstone for the development of competent and creative human resources [2]. In [3], the Basic and Secondary Education Process Standards emphasize that the learning approach in schools should be active [4], motivating for students [5], create a comfortable learning environment [6], and provide space for creativity and student autonomy [7], tailored to their diverse abilities, interests, talents, and physical as well as psychological development [8]. One of the primary focuses of national education according to the Minister of Education and Culture is to produce creative students [9]. This view aligns with [10] perspective, which emphasizes that the 2013 curriculum, in line with the needs of learning in the 21st century, underscores the importance of creativity and innovation skills. To achieve this goal, efforts are needed to impart knowledge to students and train them to think creatively.

Creative thinking can be nurtured by providing exercises, encouraging exploration from an early age, and involving students in discovery and problem-solving [11]. [12] states that one common issue in formal education is the low ability of students to think creatively. Although students' creativity can develop through practice, in practice, the teaching methods most often used by teachers involve lectures and memorization, with little guidance for creative thinking [13]. This aligns with the views of [14], which indicate that current learning is still teacher-centered, leading to a lack of independent development in students' creative thinking and discovery processes. Creative thinking, which is the process of generating ideas or solutions in problem-solving, can be developed through Project-Based Learning (PBL) approaches [15], which encourage students to think at higher levels.

As an effort to achieve successful learning outcomes and to train students to become independent and capable of creative thinking, teachers can select teaching models that align with the material being taught [16]. One teaching model that has proven effective in enhancing students' creative thinking skills is Problem-Based Learning (PBL) [17]. The PBL model not only delivers subject matter content but also engages students in problem-solving and discovery of solutions independently [18]. Moreover, the PBL model is also recommended in the 2013 curriculum as a teaching method that can facilitate the development of students' creativity.

Problem-Based Learning (PBL) is an instructional approach that emphasizes problem-solving [19]. This problem-based learning approach is closely linked to the realities experienced by students in their daily lives, allowing students to directly engage with the problems being studied, and their knowledge acquisition is not solely dependent on the teacher. In PBL, real-life problems relevant to students' experiences are used, providing opportunities for students to develop problem-solving skills and creative thinking, as well as enabling them to build new knowledge [20]. Another perspective presented by [21] mentions that problem-based learning involves two levels, where students are expected to solve presented problems and understand related issues. Thus, this approach can enhance students' ability to think creatively in problem-solving and promote independent learning.

Examining the advantages of the Problem-Based Learning (PBL) model that accommodate learning in the current era of globalization, it's evident that the PBL model is highly relevant for utilization in the learning process. This necessity will ultimately produce graduates who are ready for employment or entrepreneurship, requiring critical thinking skills, practical expertise, and the utilization of information technology according to their respective fields. The objective of this research is to investigate the influence of the Problem-Based Learning model on enhancing students' creative thinking skills using a meta-analysis approach. Thus, researchers can provide a more comprehensive and robust overview of the effectiveness of PBL in enhancing students' creative thinking skills by combining and analyzing data from various existing studies. This is expected to provide a deeper and more accurate understanding of the actual impact of using this learning model in the context of improving students' creative thinking skills.

B. Research Method

In this study, the Meta-analysis method is employed, involving several stages [22]. The first stage is to identify the research theme. The second stage involves designing the overall research framework. The third stage entails searching for relevant research samples. The fourth stage involves data collection, and the fifth stage is data analysis. The process of meta-analysis is carried out as follows [23]: Firstly, the researcher explains and defines the problem to be investigated, which is the Influence of the Problem-Based Learning Model on Enhancing Students' Creative Thinking. Secondly, the researcher searches for data relevant to the research theme, namely articles published in online journals between 2018 and 2023. Thirdly, the researcher comprehends the collected articles to identify similarities with the research problem. Lastly, the researcher performs a reanalysis of the collected articles to draw conclusions.

The data collection procedure involves searching for articles published in online journals through platforms such as Google Classroom and Google Scholar. The collected articles are then categorized based on the type of research conducted. Subsequently, each article is assigned a code for identification purposes. In the analysis process, the technique used is to compare the influence of the Problem-Based Learning Model on enhancing students' creative thinking by considering the values before and after the implementation of PBL. For data analysis, the researcher utilizes sample testing with the assistance of statistical software IBM SPSS version 25.

C. Result and Discussion

Based on the search results and data collection conducted, this study utilizes a total of 17 relevant articles pertaining to the researcher's investigated issue. The gathered data consists of diverse and pertinent articles related to the subject under study:

Table 1. Improvement of Critical Thinking Skills

No.	Article Code	Percentage *(%)*		Improvement
		Pretest	Posttest	
1.	1A	52.90	65.10	2.20
2.	2A	48.33	51.45	3.12
3.	3A	66.82	72.26	5.44

4.	4A	71.06	89.47	8.41
5.	5A	74.55	82.45	7.90
6.	6A	66.12	79.18	13.06
7.	7A	66.70	82.40	25.70
8.	8A	60.50	77.00	16.50
9.	9A	78.03	85.86	7.83
10.	10A	65.97	73.80	7.83
11.	11A	69.30	89.20	39.90
12.	12A	77.29	88.83	11.54
13.	13A	44.89	59.11	24.22
14.	14A	61.90	79.70	17.80
15.	15A	77.78	91.67	23.85
16.	16A	68.90	71.55	2.65
17.	17A	67.79	71.68	3.99
	Mean	61.43	62.91	11.22

Based on Table 1, it can be observed that there is variation in the percentage of pretest and posttest scores among the articles included in the study. The average percentage of pretest scores is 61.43%, while the average percentage of posttest scores is 62.91%. Additionally, the average increase in students' creative thinking after participating in learning using the PBL Model is 11.22%. This indicates that the implementation of the PBL Model tends to enhance students' creative thinking abilities, with a significant average improvement after participating in the learning process. However, it is important to note that there is variation in the level of improvement among different articles, which may be influenced by other factors such as instructional design, implementation quality, and student characteristics. Table 3 will present the results of the inter-subject effect test.

Table 2. Test of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	484.452[a]	1	484.452	14.163	.002
Intercept	708.797	1	708.797	20.722	.000
Pretest	484.452	1	484.452	14.163	.002
Error	513.078	15	34.205		
Total	118942.000	17	15		
Corrected Total	997.529	16			

Based on the data analysis results in Table 2, several important conclusions can be drawn. Firstly, the value of Corrected Model at 0.002, which is smaller than the significance level of 0.005, indicates that the Problem Based Learning model has a significant effect on enhancing students' creative thinking [24]. This means that there is a valid relationship between the application of the PBL Model and the improvement of students' creative thinking abilities. Secondly, the Intercept value of 0.000 is also smaller than the significance level of 0.005, indicating that the initial pretest variable is relevant in the context of this study. This signifies that students' initial characteristics before learning indeed have a significant influence on the results of improved creative thinking after using the PBL Model. Lastly, the significance test results for the Pretest with a value of 0.002, also smaller than the significance level of 0.005. This means that the null hypothesis (Ho) stating no

difference between Pretest and Posttest scores is rejected. Thus, it can be concluded that the PBL Model has a significant impact on enhancing students' creative thinking abilities.

Overall, based on the analysis results, it can be concluded that the Problem Based Learning Model effectively influences the improvement of students' creative thinking, and the research findings support the use of the PBL Model in enhancing students' creative thinking skills. Subsequently, Table 3 will present the parameter estimates results.

Table 3. Parameter Estimates

Parameter	B	Std. Error	T	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	45.804	10.062	4.552	.000	24.357	67.251
Pretest	.576	.153	3.763	.002	.250	.903

From the analysis results in Table 3, it can be observed that the significance (Sig.) values for the variable types are less than 0.005. Since these significance values are below the established significance level (0.005), the null hypothesis (Ho) stating no influence of the Problem Based Learning Model on the improvement of students' creative thinking is rejected. Conversely, the alternative hypothesis (H1) stating the influence of the PBL Model on the enhancement of students' creative thinking can be accepted.

Therefore, it can be concluded that the Problem Based Learning Model has a significant influence on enhancing students' creative thinking abilities. This conclusion reaffirms that the PBL Model can be effectively applied as a learning approach to facilitate and enhance students' creative thinking skills.

D. Conclusion

From the findings of the conducted research, it can be concluded that the implementation of the Problem Based Learning (PBL) Model has a significant impact on enhancing students' creative thinking abilities. Data analysis indicates a valid relationship between the use of the PBL Model and the improvement of students' creative thinking, as evidenced by the significance values being lower than the predetermined threshold (0.005). These results support the alternative hypothesis stating that the PBL Model has a positive effect on enhancing students' creative thinking skills, while the null hypothesis is rejected. Therefore, it can be inferred that the PBL Model can be effectively applied in educational contexts to facilitate the development of students' creative thinking skills. The implications of these findings underscore the importance of active, problem-based learning approaches that actively involve students in the learning process to stimulate and enhance their creative thinking abilities.

Furthermore, this research underscores the importance of integrating teaching strategies oriented towards developing creative thinking skills into educational curricula. Considering the findings of this study, educational institutions can integrate the PBL Model into their teaching methods to provide more meaningful

learning experiences and expand opportunities for students to develop their creative thinking abilities. Moreover, further research can be conducted to deepen understanding of the effectiveness of the PBL Model in various educational contexts and subject areas, as well as to explore more effective and measurable implementation strategies. Thus, this research not only contributes to improving the quality of education but also provides a foundation for the development of more effective pedagogy in fostering creativity and critical thinking among the younger generation.

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