



## The Effectiveness of Problem-Based Learning Methods in Improving Prospective Elementary School Teachers' Critical Thinking Skills

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### Abstract

This research was conducted to uncover the extent to which prospective elementary school teachers can utilize problem-based learning methods to improve their critical thinking skills. We employed a single-group pre-test experimental research approach, incorporating a pre-test and a post-test. 47 prospective elementary school teachers in Sarjanawiyata Tamansiswa University comprise this research sample. The analysis of data used the tests Wilcoxon and N Gain Score. These results show the problem-based learning methods that effectively enhanced the critical thinking of prospective elementary school teachers. The Wilcoxon test results reveal a statistically significant effect of problem-based learning methodologies on the development of critical thinking skills in students, with a sig value of 0.000. The test results for the means of the N Gain Score center on improving critical thinking competence in which their mean score is 0.61 and their average percentage is 61.07. Therefore, using problem-based learning methods will indeed immensely contribute much in enhancing the critical thinking in prospective elementary school teachers.

**Keywords:** *problem-based learning, critical thinking, prospective elementary school teachers.*

### **Abstrak**

Penelitian ini dilakukan untuk mengetahui sejauh mana calon guru sekolah dasar dapat memanfaatkan metode pembelajaran berbasis masalah untuk meningkatkan kemampuan berpikir kritisnya. Penelitian ini menggunakan pendekatan penelitian eksperimen pra-tes kelompok tunggal, yang terdiri dari pra-tes dan pasca-tes. Sebanyak 47 calon guru sekolah dasar di Universitas Sarjanawiyata Tamansiswa menjadi sampel penelitian ini. Analisis data menggunakan uji Wilcoxon dan N Gain Score. Hasil tersebut menunjukkan bahwa metode pembelajaran berbasis masalah efektif meningkatkan kemampuan berpikir kritis calon guru sekolah dasar. Hasil uji Wilcoxon menunjukkan bahwa metodologi pembelajaran berbasis masalah berpengaruh signifikan secara statistik terhadap pengembangan kemampuan berpikir kritis siswa, dengan nilai sig sebesar 0,000. Hasil uji rata-rata N Gain Score berpusat pada peningkatan kemampuan berpikir kritis dengan nilai rata-rata 0,61 dan persentase rata-rata 61,07. Oleh karena itu, penggunaan metode pembelajaran berbasis masalah akan sangat membantu dalam meningkatkan kemampuan berpikir kritis calon guru sekolah dasar.

**Kata kunci:** *pembelajaran berbasis masalah, berpikir kritis, calon guru sekolah dasar.*

### **INTRODUCTION**

Higher education must give students the critical thinking abilities they need for both their personal and professional lives if it is to satisfy the needs of the twenty-first century (Aldowah et al., 2019; DeAngelo, 2020; Mwangi & Ingado, 2020; Rabiah, 2019). The skills required in the 21st century include critical thinking, creativity, communication, collaboration, and problem-solving. Critical thinking helps children tackle the dynamic complications of the world they are living in today. As such, students need the appropriate abilities to evaluate, synthesize, analyze, and apply knowledge in real contexts (Gust et al., 2024; Le & Chong, 2024). Pupils must possess the skills necessary to assess, synthesise, analyse, and apply their knowledge in practical settings. However, students often focus too much on mastering the material without developing critical thinking. In fact, this ability is very important in dealing with complex problems, making the right decisions, and adapting to changes that occur (Babaci & Wilhite, 2020; Cottrell, 2023; Saifer, 2018; Syafitri et al., 2021). Future leaders, such as students, must possess critical thinking abilities to handle difficult problems in the workplace. According to Kim et al. (2019), Md (2019), Rosidin et al. (2019), Saykili (2019), and Suparni (2020), these talents include analytical, synthetic, evaluative, and creative thinking. In actuality, though, a large number of pupils still lack these skills, as the focus of education is often on content acquisition rather than the development of critical thinking ability.

When researchers conducted observations, they found that prospective elementary school teachers at Universitas Sarjanawiyata Tamansiswa (UST) lacked critical thinking abilities, among other issues. This happens as a result of inadequate knowledge of the subject matter, inefficient teaching strategies, and a dearth of challenge and excitement during the teaching and learning process. In prospective elementary school teachers classes, lecture and discussion techniques are typically employed as teaching strategies. Students who use this learning style typically have lower success rates in developing critical thinking abilities. Finding alternate teaching strategies that are better at developing these skills is therefore

essential. There are still a lot of issues with pupils' critical thinking abilities nowadays. Some studies Bahri & Martunis (2016), Mahanal et al. (2019), Prastiwi (2022), Saputra et al. (2019), Siburian et al. (2019), Sumarni & Kadarwati (2020), and Supriyatno et al. (2020) mention that many Indonesian students have difficulties in obtaining the ability of critical thinking. Possible reasons for this could be limited participation by students in class discussions and creative assignments, along with a lack of support on the part of educators and educational establishments to build up the critical and creative thinking skills of their students.

Programs to enhance students' critical thinking abilities have been established by several Indonesian educational institutions (Hasim, 2020; Hr & Wakia, 2021; Marlina, 2020; Suparni, 2020). Curriculum programs that teach kids how to think critically are one example. Attending seminars and workshops outside of the classroom is another way to enhance critical thinking abilities. Researchers are interested in finding out ways to use alternative learning approaches, particularly problem-based learning, to help prospective elementary school teachers develop their critical thinking abilities. With this method, students would be able to be actively participative and could extend their critical, analytical, and creative thinking. Prospective elementary school teachers at UST should be trained in developing their critical thinking skills so that graduates can rise to challenges faced in the existing educational setting (UST, 2022). Therefore, this research is conducted to investigate how well prospective elementary school teachers in UST could develop their critical thinking abilities with the use of problem-based learning techniques.

Students address real-world problems as part of their education when they use problem-based learning (Jensen et al., 2019; Moallem et al., 2019; Moust et al., 2021; Tan, 2021). Students who use this method of instruction are given problems or scenarios that need investigation, analysis, creativity, and critical thinking to solve. The following are some of the pillars of problem-based learning, according Jensen et al. (2019), a) give pupils the chance to actively engage in their education; b) encourage their critical thinking abilities and inventiveness; c) integrate various subject lessons in problem-solving; d) develop a lifelong learning attitude; e) provide relevant and challenging challenges for students. Stages of problem-based learning include (Moust et al., 2021): a) identification of a problem or situation that requires solving; b) forming a team or group to work on the problem; c) searching for and gathering relevant information; d) analysis of information and decision-making on the best solution; e) implementation of the solution and evaluation of the results achieved. Some advantages of problem-based learning are (Tan, 2021): a) develop students' critical thinking skills and creativity; b) motivate students in learning; c) integrate various subjects in problem-solving; d) develop a lifelong learning attitude. However, there are also some disadvantages to problem-based learning, including a) requires longer time to implement; b) requires adequate facilities and resources to support learning; c) is less suitable for older students who like to learn independently and individually (Tan, 2021).

The capacity to carefully and completely examine information, analyse it, and come to logical and reasonable conclusions is known as critical thinking ability (Anggraeni et al., 2023; Ayçiçek, 2021; Hyytinen et al., 2021). It involves an individual's ability to gather information, process information, evaluate information, and use information to make informed decisions. There are several elements in critical thinking skills (Song et al., 2024; Tasgin & Dilek, 2023), namely: a) Identify and formulate problems appropriately. b) Collect

and analyse relevant data and information. c) Evaluate information critically and objectively. d) Develop rational and logical arguments. e) Make the right decision based on the information that has been analyzed. Several factors influence critical thinking skills, namely: a) experience; b) education; c) environment; e) motivation; and e) emotions (Deng et al., 2023; Rodríguez-Sabiote et al., 2022).

Both constructivism theory and collaborative learning theory bolster the relationship between problem-based learning and critical thinking skills (Do et al., 2023; O'Connor et al., 2022; Pande & Bharathi, 2020). According to constructivism theory, students develop their understanding by solving problems and participating in active learning (Marnewick, 2023). In the meantime, students should work together to achieve learning objectives, according to collaborative learning theory (Lyu et al., 2023). Students are encouraged to collaborate, learn actively, and deepen their understanding as they solve problems through problem-based learning. Through an active, participatory, and collaborative learning style, it improves cognitive abilities. Pupils are exposed to real-world issues that call for more advanced critical thinking abilities to solve (Fedi et al., 2019).

Previous studies have indicated that education orientated towards improving analytical and conceptual thinking skills contributes positively to students' academic achievement and helps them prepare for their future careers and lives (Nurhayati & Angraeni, 2017; Palar, 2020; Sakti, 2019; Suhaeni & Sunarti, 2020). However, there were differences in the research variables and procedures between these studies. This study, therefore, investigates how much a problem-based learning strategy enhances critical thinking skills among students. This approach employs activities such as group discussion, case study, and projects that allow for critical and creative thinking processes. It is envisioned from this research that students will achieve enhanced critical thinking learning outcomes and further develop effective teaching practices.

## **METHODS**

In order to examine the effects, research participants are given specific treatments in this study's pre-experiment research technique, which combines a quantitative approach (Abdussamad, 2021; Fauzi et al., 2022; Hardani, 2020; Nurdin & Hartati, 2019; Sidiq & Choiri, 2019). One Group Pretest-Posttest was the study method employed, where data were gathered both before and after treatment to assess any changes that had taken place (Burke, 2014; Smith & Hasan, 2020). The purpose of this study is to measure how an intervention affects the participants. By comparing the intervention's results to the pre-treatment condition, this technique enables a more accurate representation of the therapy effect.

O1	X	O2
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O1 = pretest value (before treatment)  
X = PBL Method  
O2 = posttest value (after treatment)

The participants in this study were students enrolled in the Indonesian Language and Literature Learning for Elementary Schools course in class D, semester 4 of the Elementary School Teacher Education Study program, UST Yogyakarta. There were forty female pupils and seven male students in total, 47 individuals in the population. Students chosen to reflect the population as a whole comprise the study's sample (Fauzi et al., 2022).

The whole population was used as a study sample through the use of saturated sampling (Smith & Hasan, 2020). When comparing data obtained before and after treatment, the t-test is a quantitative descriptive and inferential data analysis approach that is used to find significant changes (Supriadi, 2021). First, a normality test was run using the Shapiro-Wilk approach using SPSS version 24 software (Muhid, 2019).

In the present research, the t-test was conducted at a 0.05 significance level to test the hypothesis. If the significance value (Sig) is greater than 0.05 or the calculated t value is less than the t table value, the null hypothesis,  $H_0$ , is accepted in decision-making. If the t-value and Sig value are higher than the tabular value of t,  $H_0$  is rejected. This test is designed to explore how much problem-based learning strategies can support the student's critical thinking skills while studying Indonesian literature and language. Data in this assessment were obtained from the pretest and posttest. If the t value is higher than the t table value, then the hypothesis can be accepted; if the t value is less than the t table value, then the hypothesis can be rejected. The alternative hypothesis,  $H_a$ , states that problem-based learning has a significant impact on improving the ability in critical thinking, whereas the null hypothesis,  $H_0$ , assumes no significant level relationship between problem-based learning and the skill of critical thinking.

Before the research was done, an instrument validity test was performed to define the extent at which the study instrument was able to accurately measure. From the results of the validity test, each of the question items has a calculated r value with a significance value of 0.000, which is bigger compared to the 5 percent significant r table value, 30. This means that all of the problems in the study are highly valid and can measure what there is to be measured. The reliability of the study instrument was confirmed by the researchers by calculating Cronbach's alpha with the help of SPSS 24 software. An instrument is reliable, according to (Wahyuning, 2021), if its Cronbach alpha value is greater than 0.6. For the results, the Cronbach's alpha is 0.900, which is higher than the threshold value. Therefore, this reliability test result proves that the items of the study are trustworthy.

## **RESULTS AND DISCUSSION**

The Shapiro-Wilk normality test was utilised as the required test to ascertain if one sample was normal prior to testing the hypothesis because there was only one class or group test in this investigation. From the histogram created, it is quite apparent that the distribution of the data is not normal. On the histogram, neither the pretest nor the posttest indicates a symmetrical bell on the graph. More so, test results prove that the distribution of the data is not normal since the significance value, sig, is less than 0.05. The researcher used a non-parametric test method called the Wilcoxon Test to prove whether problem-based learning techniques are beneficial in enhancing the critical thinking ability of students in Indonesian elementary school language and literature courses.

Table 1. Wilcoxon Test Results

		Ranks		
		N	Mean Rank	Sum of Ranks
Posttest PBL - Pretest PBL	Negative Ranks	0a	.00	.00
	Positive Ranks	45b	23.00	1035.00
	Ties	2c		
	Total	47		

a. Posttest PBL < Pretest PBL

b. Posttest PBL > Pretest PBL

c. Posttest PBL = Pretest PBL

Table 2. Wilcoxon Statistical Test

Statistical Test <sup>a</sup>	
Posttest PBL - Pretest PBL	
Z	-5,859b
Asim. Sig. (2-ekor)	.000

a. Wilcoxon Signed Rank Test

b. Based on negative ratings.

From the descriptive in Table 1, the mean of positive review values is 23.00, and the average value of negative ratings is 0.00. That shows how well the use of the problem-based learning method enhanced critical thinking skills both before and after. Table 2 of the Wilcoxon test result showed the significant value of 0.000 is less than alpha 0.05. Therefore,  $H_0$  is rejected; instead,  $H_1$  is accepted. It then means that the critical thinking skills of prospective elementary school teachers before and after the implementation of a problem-based learning methods were not assessed equally. This assertion agrees with the works of Anggraeni et al. (2023), who indicated that critical thinking skill plays a core role in post-secondary education and that it can be fostered through PBL. Maor et al. (2023) also explained the importance of PBL for the development of competencies related to the 21st century, which are critical thinking, among others, and the introduction of these skills in the learning process.

The general findings of the present study, on the problem-based learning methods enhancing critical thinking capacity in students, go hand in hand with prior research that has called for instructing 21st-century skills such as critical thinking in the classroom. For example, Dilekçi & Karatay (2023) have identified one of the breakthroughs concerning the impacts of the information era on education as the adoption of problem-based methodologies in learning. In this regard, the research findings provide some empirical evidence for the study done by Liu & Pásztor (2022), on the impact of PBL on instructional interventions to foster critical thinking in higher education. Past literature has shown that PBL significantly influences CT with a large effect size. These findings imply that providing problem-based learning methodologies to the fourth-semester students of elementary school teacher education study program, UST will significantly enhance their critical thinking ability. In addition, the researchers tested for a N Gain Score to determine the effect that problem-based

learning strategies have on the critical thinking skills of students based on the interpretation of the N Gain Score provided by Meltzer (2002).

Table 3. Guidelines for Interpretation of N Gain Score

0.7	High
0.3 – 0.7	Medium
0.3	Low

Table 4. Test Results of N Score Gain Calculation

<b>Categorization</b>	<b>F</b>	<b>Averages Gain Index Results</b>	<b>Gain Index Criteria</b>
Height	20	0,61	Medium
Medium	21		
Low	6		
<b>Amount</b>	<b>47</b>		

Table 4: The test results of the N Gain Score yield an average N Gain Score of 0.61 with medium category. This therefore showed that prospective elementary school teachers within the medium category, after being subjected to problem-based learning strategies during the fourth semester of UST, greatly improved their capacity for critical thought. The use of problem-based learning strategies alone may not be enough to ensure that students develop critical thinking skills comprehensively. Certain factors could emanate from a shallow grasp of concepts. This is further replicated in the study conducted by Li et al. (2023), where it was established that for optimal learning outcomes to be derived and critical thinking ability to be enhanced, students have to possess good concept knowledge. Previous research done by Resnick (2023) also underlined that instructors' skills relating to the enhancement of students' thinking need to be developed, and their potential to lead HOTS is not well developed. This therefore means that a lack of support and guidance from the teachers' side can lead to lacunars in the implementation of problem-based learning models and the development of critical thinking skills of a student. It was also pointed out that Qian et al. (2023) emphasized the strict demands of the curriculum added to the stringency of time, which might mean a decrease in the hours and thus discourage developing critical thinking skills on a deeper level. This is not to say that problem-based learning strategies have not been found helpful in developing critical thinking skills among students. It is, however, important to consider the underlying factors that influence how students engage in and build their critical thinking skills for optimization of outcomes (Chen et al., 2024; Cheng et al., 2023; Hsu et al., 2022; Karaer et al., 2024; Yang et al., 2023).

## CONCLUSIONS

The results and the subsequent discussion affirm that problem-based learning tools enhance the critical thinking of students. There is a significant difference in the students' perceived values of their critical thinking skills before and after the treatment of using problem-based learning methodologies. The statistical tests denote that using problem-based learning strategies enhances students' critical thought capability much better. This result is congruent with recent studies highlighting that critical thinking skills should be taught in

higher education and that the problem-based learning methodology is proper for the enhancement of that skill. However, a variety of factors may differ in a student's critical thinking skills development and in using the problem-based learning methodology. Poor conceptual understanding, lack of guidance and support from teachers, time constraints, and high demands of curriculum requirements may hinder the best outcome. These shall be put into consideration to maximize the benefit of problem-based learning strategies in developing students' critical thinking skills..

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