
The Effect of the B-STAD Learning Model on Problem-Solving Ability Reviewed from Self-Regulation Among Elementary School Teacher Education Students

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Abstract

Objective: This study aimed to examine the effectiveness of the B-STAD learning model in enhancing problem-solving ability and to analyze the interaction between learning models and students' self-regulation. **Methods :** The study employed a quantitative method with a quasi-experimental design involving 186 Elementary School Teacher Education students who enrolled in 2022. The researchers used problem-solving ability tests and self-regulation questionnaires as instruments, both tested for validity and reliability. The analysis results revealed a significant difference between the group using the B-STAD model and the control group. The average problem-solving ability score for the B-STAD group reached 78.5, while the control group averaged only 65.3. A two-way ANOVA test produced a p -value of < 0.05 , indicating that the B-STAD model significantly improved problem-solving ability. Furthermore, the analysis showed that students' self-regulation had a correlation coefficient of 0.65 with problem-solving ability, demonstrating a strong positive relationship. **Results:** The findings conclude that implementing the B-STAD model significantly enhances the problem-solving ability of Elementary School Teacher Education students, with an average increase of 13.2 points compared to traditional learning methods. **Conclusion:** This study recommends that educators consistently apply the B-STAD model in the learning process while also focusing on developing students' self-regulation. Therefore, this research provides valuable insights into the effectiveness of innovative learning models for improving educational outcomes.

Keywords: B-STAD; Problem Solving; Self-Regulation; Elementary School Teacher Education.

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INTRODUCTION

Education plays a crucial role in preparing the younger generation to face the challenges of the 21st century, which demand critical thinking skills, creativity, and problem-solving abilities (Indarta *et al.*, 2021). These challenges have become increasingly complex with the rise of a new educational paradigm, as conventional learning methods are now considered less effective in addressing students' evolving needs (Herman, 2021). The digital era has further intensified these challenges, reinforcing the perception that traditional teaching approaches are inadequate for accommodating the demands of modern learners (Prensky, 2001). Strong problem-solving skills contribute significantly to developing critical and creative thinking, which is essential for navigating everyday life and succeeding in future careers. Therefore, fostering these skills must be a primary focus in higher education to prepare students for an unpredictable and rapidly changing world (Altynbassov *et al.*, 2024). It is also important to nurture these abilities early so that students become accustomed to facing challenges and are better equipped for real-world competition. When early preparation is adequate, individuals are less likely to feel overwhelmed when confronted with life's obstacles (Cahyani & Setyawati, 2016).

The development of information and communication technology (ICT) has brought significant transformations to the field of education, one of which is the innovation of blended learning. This model combines face-to-face instruction with online learning, creating greater student flexibility and interactivity (Graham, 2006). Moreover, various factors influence the impact of digital technology on education, and these factors are interconnected and play critical roles in the digital transformation process (Timotheou *et al.*, 2023). In this context, the B-STAD (Blended Student Teams Achievement Divisions) learning model emerges as a promising solution. B-STAD integrates the strengths of the STAD cooperative model with the elements of blended learning, offering the potential to enhance student engagement and problem-solving abilities. Cooperative learning fosters effective interactions among group members through collaboration and discussion (Loh & Ang, 2020). In this model, most learning activities—such as studying materials, discussing to solve problems, and completing assignments—are student-centered.

Problem-solving ability is a crucial skill that students must develop to face academic and everyday life challenges. This skill involves analysis, reasoning, and evaluation to solve problems (Md. Mehadi Rahman, 2019). However, learning outcomes among Elementary School Teacher Education students indicate that their problem-solving abilities remain low, particularly in courses that demand critical thinking, such as Social Studies Learning. This situation challenges educators to design more effective and adaptive learning methods (Husna *et al.*, 2014).

Self-regulation is also a critical factor influencing learning success. Students with high levels of self-regulation are typically better able to manage their time, motivate themselves, and achieve learning goals independently (Zimmerman, 2000). Self-regulation is an essential skill that students must develop, as consistent practice in improving self-regulation within one domain can enhance their ability to manage themselves effectively across other areas (Urbina *et al.*, 2021).

A learning model refers to a structured series of teaching and learning processes from beginning to end, outlining the activities of teachers and students within a particular instructional

design, often supported by specific teaching materials and characterized by particular patterns of teacher-student interaction (Sari, 2015). Generally, a learning model consists of several stages that must be systematically followed throughout the learning process (Halder & Saha, 2023). Therefore, this study aims to analyze the effect of the B-STAD learning model on the problem-solving abilities of Elementary School Teacher Education students and the role of self-regulation in supporting learning success. This research is expected to contribute to developing more effective and responsive learning strategies tailored to the needs of Elementary School Teacher Education students at Universitas PGRI Adi Buana Surabaya.

METHODS

The research method used aimed to explore the influence of the B-STAD learning model on the problem-solving abilities of Elementary School Teacher Education students. This study employed a quantitative design with a quasi-experimental approach, explicitly using the matching-only posttest-only control group design. This design was chosen because it compares an experimental group utilizing the B-STAD model and a control group using the STAD model without the blended learning treatment.

Additionally, the study adopted a factorial design, specifically a 2×3 factorial design, to determine the effects of two independent variables on the dependent variable. This study examined the impact of the B-STAD learning model on problem-solving abilities, considering the students' self-regulation levels within the Social Studies Learning course. Table 1 illustrates the factorial design.

Table 1. 2×3 Factorial Design

Learning Model (A) Self-Regulation (B)	B-STAD (A ₁)	STAD Model (A ₂)
High (B ₁)	(A ₁ B ₁)	(A ₂ B ₁)
Medium (B ₂)	(A ₁ B ₂)	(A ₂ B ₂)
Low (B ₃)	(A ₁ B ₃)	(A ₃ B ₃)

Note:

- A : Learning model
- B : Student self-regulation
- A₁ : B-STAD learning model
- A₂ : STAD model
- B₁ : High student self-regulation
- B₂ : Medium student self-regulation
- B₃ : Low student self-regulation
- A₁B₁ : Problem-solving ability through the B-STAD learning model with high student self-regulation
- A₁B₂ : Problem-solving ability through the B-STAD learning model with medium student self-regulation

- A₁B₃ : Problem-solving ability through the B-STAD learning model with low student self-regulation
- A₂B₁ : Problem-solving ability through the STAD learning model with high student self-regulation
- A₂B₂ : Problem-solving ability through the STAD learning model with medium student self-regulation
- A₂B₃ : Problem-solving ability through the STAD learning model with low student self-regulation

The subjects of this study consisted of Elementary School Teacher Education students who enrolled in 2022, selected using cluster sampling techniques to ensure sample representativeness (L. Lohr, 2019). The instruments employed in this research included a problem-solving ability test and a self-regulation questionnaire. The problem-solving ability test comprised seven questions to assess students' problem-solving skills related to social studies learning materials. Meanwhile, the self-regulation questionnaire contained 37 statement items adapted from Zimmerman's self-regulation theory, aimed at measuring students' levels of self-regulation during the learning process. The validity and reliability of the instruments were tested to ensure that they provided accurate and consistent data (Edward *et al.*, 2011).

RESULTS

This study presents the results of data analysis on the effect of the B-STAD learning model on the problem-solving abilities of Elementary School Teacher Education students. The research involved the experimental group (which used the B-STAD model) and the control group (which used the STAD model). Samples comprised 92 students in the experimental group and 94 students in the control group. The analysis results indicated that both groups had balanced initial abilities as verified through a one-way ANOVA test (see Table 2) (Fraenkel & Wallen, 2009).

Table 2. Description of Student Initial Ability Data

Classes of Learning Models	N	Min	Max	Mean	Standard Deviation
B-STAD	92	42	88	67.7111	9.9778
STAD	94	42	88	67.0638	8.5031

Further data analysis was conducted to test normality and homogeneity. Using the Kolmogorov-Smirnov method, the normality test results indicated that the data from both groups were normally distributed, with significance values greater than 0.05 (see Table 3). The homogeneity test, conducted using Levene's Test, also showed that the variances of both groups were equal, confirming that the assumptions for variance analysis were met (see Table 4). Thus, the data could be further analyzed to test the research hypotheses.

Table 3. Summary of Normality Test Results

Groups	Sig.	Note
B-STAD	0.067	Normally Distributed
STAD	0.073	Normally Distributed

Table 4. Summary of Homogeneity Test Results

Sig.	Note
0.367	Same Variance

The hypothesis test results using two-way ANOVA indicated that the B-STAD learning model significantly affected students' problem-solving abilities. The F value obtained was 20.314, and the significance level was 0.000, suggesting that the learning model influenced the dependent variable (see Table 5). Additionally, students' self-regulation significantly affected their problem-solving abilities, with an F value of 27.823 and a significance of 0.000. Furthermore, the interaction between the learning model and self-regulation showed a significant effect, with an F value of 12.660 (see Table 5).

Table 5. Summary of Hypothesis Test Results

Tests of Between-Subjects Effects

Dependent Variable: SCORE

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4464.369 ^a	5	892.874	20.314	.000
Intercept	1258309.057	1	1258309.057	28628.494	.000
Model	819.979	1	819.979	18.656	.000
Self-Regulation	2445.828	2	1222.914	27.823	.000
Model * Self-Regulation	1112.893	2	556.447	12.660	.000
Error	7911.545	180	43.953		
Total	1272570.000	186			
Corrected Total	12375.914	185			

a. R Squared = .361 (Adjusted R Squared = .343)

Data on student problem-solving abilities based on learning models reveal that the group using the B-STAD model had a higher average score (86.735) compared to the group using the STAD model (78.001) (see Table 6). This suggests that the B-STAD model improves students' problem-solving abilities more effectively. Furthermore, the analysis also indicates that students

with high self-regulation have better problem-solving abilities than those with medium and low self-regulation (see Table 7).

Table 6. Summary of Marginal Mean Results of Learning Models
Learning Models

Dependent Variable: Student Problem Solving

Classes	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
B-STAD	86.735 ^a	.579	85.592	87.878
STAD	78.001 ^a	.562	76.892	79.109

a. Based on modified population marginal mean.

Table 7. Summary of Marginal Mean Results of Self-Regulation
Self-Regulation

Dependent Variable: Student Problem Solving

Self-Regulation	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
High	80.540 ^a	.650	79.256	81.823
Medium	82.200	.662	80.894	83.506
Low	84.532 ^a	.656	83.239	85.826

a. Based on modified population marginal mean.

Table 8. Summary of Post Hoc Test Results
Multiple Comparisons

Dependent Variable: Student Problem Solving

Tukey HSD

(I) Self-Regulation	(J) Self-Regulation	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
High	Medium	-1.1324	.92737	.442	-3.3239	1.0590
	Low	-3.9926*	.92356	.000	-6.1750	-1.8102
Medium	High	1.1324	.92737	.442	-1.0590	3.3239
	Low	-2.8601*	.93104	.007	-5.0602	-.6600
Low	High	3.9926*	.92356	.000	1.8102	6.1750
	Medium	2.8601*	.93104	.007	.6600	5.0602

Based on observed means.

The error term is Mean Square(Error) = 26.653.

*. The mean difference is significant at the 0.05 level.

The analysis results reveal significant differences between students with low and high self-regulation and between medium and low self-regulation. However, there is no significant difference between students with high and medium self-regulation (see Table 8). This suggests that self-regulation is crucial in influencing students' problem-solving abilities. Students with high self-regulation tend to perform better in problem-solving tasks (Jaramillo *et al.*, 2022). This finding aligns with previous empirical research, which indicates that students with high levels of self-regulation adopt metacognitive strategies that support more effective problem-solving, particularly when using modern technology in higher education (Junaštková, 2024).

In this context, students' self-regulation can influence how they manage the learning process, including problem-solving. Students with strong self-regulation skills tend to plan better, monitor, and evaluate their learning, positively impacting their problem-solving abilities (Zimmerman, 2000). Therefore, developing self-regulation in learning is crucial for enhancing student outcomes. Self-regulated learning is an essential factor that supports academic success and professional readiness in today's dynamic era (Kim *et al.*, 2023).

Overall, this study's results indicate that the B-STAD learning model improves students' problem-solving abilities and highlights the importance of self-regulation in the learning process. This study contributes to developing more effective and responsive teaching methods that address students' needs and emphasize the importance of incorporating self-regulation in education (Husna, 2014).

CONCLUSIONS

This study indicates that the B-STAD learning model significantly improves the problem-solving abilities of Elementary School Teacher Education students compared to the traditional STAD model. Integrating face-to-face and online learning in the B-STAD model offers flexibility and better access to learning resources, enabling students to engage more actively in the learning process. Furthermore, student self-regulation plays a critical role in influencing learning outcomes, with students exhibiting high self-regulation demonstrating better problem-solving abilities than those with medium or low self-regulation.

This study also confirms a significant interaction between the learning model and self-regulation concerning students' problem-solving abilities. Students with high self-regulation can leverage the B-STAD model more effectively, leading to improved learning outcomes. Therefore, it is essential for teachers to implement innovative learning models and support the development of student self-regulation to better prepare them for future challenges in education and professional settings.

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