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Integrating self-efficacy reinforcement into problem-based learning enhances critical creative and communicative skills

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ABSTRACT

This study aimed to examine the effect of Problem-Based Learning (PBL) integrated with self-efficacy reinforcement on students' critical thinking, creative thinking, and communicative skills in Civic Education. A quantitative quasi-experimental design with a pretest–posttest nonequivalent control group was employed involving 68 tenth-grade students divided into experimental (n = 34) and control (n = 34) groups. Data were collected using critical thinking essay tests, observation rubrics for creative thinking and communicative skills, and a self-efficacy questionnaire. The data were analyzed using paired-samples t-tests, independent-samples t-tests, normalized gain (N-Gain), and MANOVA. The experimental group demonstrated significantly greater improvements than the control group in critical thinking (N-Gain = 60.81%), creative thinking (59.09%), and communicative skills (54.65%). MANOVA indicated a significant multivariate effect ($F = 44.285$, $p < 0.001$; Pillai's Trace = 0.675), while students also exhibited high self-efficacy across all measured dimensions. These findings support the integration of self-efficacy reinforcement into PBL as an effective instructional approach within the context of this study.

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Introduction

Contemporary education increasingly emphasizes the development of higher-order thinking and transferable competencies that enable students to respond effectively to complex social, technological, and global challenges. Critical thinking, creative thinking, communication, and collaboration have become essential competencies for preparing students to address increasingly complex societal demands (Nadziroh et al., 2025, 2026). Within Civic Education, these competencies are particularly important because students are expected not only to understand democratic values and citizenship concepts but also to critically analyze public issues, formulate innovative solutions, and communicate evidence-based arguments responsibly. However, evidence from previous studies indicates that Civic Education in many secondary schools continues to rely on teacher-centered instruction characterized by memorization-oriented activities and limited student participation, resulting in insufficient opportunities to cultivate higher-order thinking and communication skills (Keegan et al., 2017; Suarniati et al., 2019). These conditions highlight the need for instructional approaches that actively engage students in authentic learning experiences while simultaneously fostering the competencies required in twenty-first-century education.

Problem-Based Learning (PBL) has been widely recognized as an effective student-centered instructional model that promotes inquiry, collaboration, and higher-order thinking through authentic problem solving

(McInerney & Adshead, 2013; Weaver, 1998). Previous studies have consistently reported that PBL improves critical thinking, creativity, collaborative learning, and academic achievement across various educational contexts (Ahrari et al., 2016; Suarniati et al., 2019). Nevertheless, these findings also suggest that the effectiveness of PBL is not always consistent because students often experience difficulties maintaining active participation and persistence when confronted with complex learning tasks. This limitation indicates that successful implementation of PBL depends not only on instructional design but also on learners' psychological readiness to engage confidently in challenging problem-solving activities.

Among the psychological factors influencing learning success, self-efficacy has consistently been identified as a key determinant of students' cognitive engagement and academic performance. Pérez et al. (2022) define self-efficacy as individuals' beliefs in their capability to organize and execute actions required to accomplish specific tasks successfully. Students with stronger self-efficacy tend to demonstrate greater persistence, intrinsic motivation, resilience, and self-regulated learning when facing academic challenges (Lau, 2019; Yang & Chung, 2009). Previous studies have also reported positive associations between self-efficacy and critical thinking, creativity, communication competence, and academic achievement (Budiman et al., 2026; Surya et al., 2025). Within a Problem-Based Learning environment, strengthening students' self-efficacy is expected to increase their confidence to explore ideas, collaborate with peers, defend arguments, and persist throughout complex inquiry processes, thereby supporting the development of higher-order thinking and communication skills.

Although previous studies have confirmed the effectiveness of Problem-Based Learning and the importance of self-efficacy in improving learning outcomes, several important gaps remain. Existing research has generally examined Problem-Based Learning and self-efficacy as separate constructs, while studies that systematically integrate self-efficacy reinforcement into every phase of the Problem-Based Learning process remain limited (Ningsih et al., 2025; Rosário & Raimundo, 2024). Moreover, most studies have focused on a single learning outcome, such as critical thinking or academic achievement, rather than simultaneously examining critical thinking, creative thinking, and communicative skills as interconnected twenty-first-century competencies. Empirical evidence regarding this integrated approach in Civic Education, particularly at the Indonesian secondary school level, is also still limited (Siregar, 2025a). These limitations demonstrate the need for instructional models that integrate cognitive and motivational dimensions to achieve more comprehensive learning outcomes.

Therefore, this study investigates the effectiveness of Problem-Based Learning integrated with systematic self-efficacy reinforcement in improving students' critical thinking, creative thinking, and communicative skills simultaneously in Civic Education. Unlike previous studies, this research embeds self-efficacy reinforcement throughout each phase of the Problem-Based Learning process and evaluates its effectiveness across three interrelated competencies using a quasi-experimental design and multivariate analysis. This integrated instructional framework constitutes the primary contribution of the study by combining cognitive, collaborative, and motivational perspectives within a single learning model. The findings are expected to enrich the literature on student-centered learning and provide empirical evidence for educators seeking effective instructional strategies to enhance higher-order thinking and communication skills in secondary Civic Education.

Method

This study employed a quantitative approach using a quasi-experimental pretest–posttest nonequivalent control group design to examine the effectiveness of Problem-Based Learning (PBL) integrated with self-efficacy reinforcement on students' critical thinking, creative thinking, and communicative skills in Civic Education. The study was conducted at SMAN Titian Teras, Jambi Province, Indonesia, involving 68 tenth-grade students divided into two intact classes: an experimental group (Class X E3; n = 34) and a control group (Class X E6; n = 34). The classes were purposively selected because they had comparable academic achievement, class size, and learning characteristics based on school records and pretest results, thereby reducing potential selection bias. Both groups completed pretests before the intervention to establish baseline equivalence and posttests after the intervention. The instructional program was implemented over six classroom meetings. The experimental group received Problem-Based Learning integrated with systematic self-efficacy reinforcement, whereas the control group received conventional teacher-centered instruction.

The instructional intervention followed the five stages of Problem-Based Learning: problem orientation, collaborative investigation, solution development, presentation, and reflection. Self-efficacy reinforcement was systematically embedded throughout each stage by providing progressively challenging learning tasks (mastery experiences), constructive teacher feedback (verbal persuasion), collaborative peer interaction (vicarious learning), and reflective activities designed to strengthen students' confidence in solving authentic civic problems and communicating their ideas. Data were collected using four instruments: a seven-item essay test measuring

critical thinking based on Bloom's higher-order cognitive levels (C4–C6) and Glaser's indicators, observation rubrics assessing creative thinking and communicative skills, and a Likert-scale self-efficacy questionnaire covering the dimensions of magnitude, generality, and strength. All instruments underwent expert validation, while the critical thinking test demonstrated excellent reliability (Cronbach's $\alpha = 0.971$), and the observation rubrics and questionnaire met acceptable validity requirements before implementation.

Data were analyzed using IBM SPSS Statistics 30. Descriptive statistics were first calculated to summarize students' performance. Prior to hypothesis testing, the assumptions of normality, homogeneity of variance, homogeneity of covariance matrices, and the absence of multicollinearity among the dependent variables were examined using the Kolmogorov–Smirnov test, Levene's test, Box's M test, and correlation analysis, respectively. Differences within each group were analyzed using paired-samples t-tests, whereas differences between groups were examined using independent-samples t-tests. Learning effectiveness was evaluated using the normalized gain (N-Gain) index, while the simultaneous effects of the intervention on critical thinking, creative thinking, and communicative skills were examined using Multivariate Analysis of Variance (MANOVA). Statistical significance was established at $p < 0.05$ for all analyses.

Results and Discussions

This study examined the effect of Problem-Based Learning (PBL) integrated with self-efficacy reinforcement on students' critical thinking, creative thinking, and communicative skills in Civic Education. Prior to hypothesis testing, the data were examined for normality and homogeneity and met all assumptions required for parametric analyses. The effectiveness of the intervention was subsequently evaluated using paired-samples t-tests, independent-samples t-tests, normalized gain (N-Gain) analysis, and multivariate analysis of variance (MANOVA). The findings are presented according to each dependent variable, followed by the multivariate results and students' self-efficacy outcomes.

Table 1. Descriptive Statistics of Pretest and Posttest Scores

Variable	Group	Pretest Mean ± SD	Posttest Mean ± SD	Mean Difference
Critical Thinking	Experimental	52.24 ± 14.03	82.35 ± 10.52	30.12
	Control	54.12 ± 10.93	65.06 ± 12.85	10.94
Creative Thinking	Experimental	51.29 ± 11.75	80.94 ± 8.47	29.65
	Control	52.94 ± 11.01	62.82 ± 13.30	9.88
Communicative Skills	Experimental	52.12 ± 15.18	81.65 ± 8.76	29.53
	Control	53.53 ± 12.06	64.12 ± 15.74	10.59

Table 1 presents the descriptive statistics for the pretest and posttest scores of both groups. The experimental group demonstrated considerably larger improvements across all three learning outcomes than the control group. The greatest increase was observed in critical thinking skills (30.12 points), followed by creative thinking (29.65 points) and communicative skills (29.53 points). In contrast, the control group exhibited relatively modest improvements in all variables.

Table 2. Summary of Paired and Independent Samples t-Test Results

Variable	Paired t-test Experimental (p)	Paired t-test Control (p)	Independent t-test	p-value
Critical Thinking	<0.001	0.001	6.072	<0.001
Creative Thinking	<0.001	0.005	6.697	<0.001
Communicative Skills	<0.001	0.001	5.674	<0.001

Table 2 summarizes the inferential statistical analyses. The paired-samples t-tests revealed significant improvements between pretest and posttest scores in both groups. However, independent-samples t-tests consistently showed significant differences favoring the experimental group across all dependent variables ($p < 0.001$), indicating the superiority of PBL integrated with self-efficacy reinforcement over conventional instruction.

Table 3. N-Gain Analysis

Variable	Experimental (%)	Category	Control (%)	Category
Critical Thinking	60.81	Moderate	18.22	Low
Creative Thinking	59.09	Moderate	13.26	Low
Communicative Skills	54.65	Moderate	19.67	Low

Table 3 presents the normalized gain scores for each learning outcome. The experimental group consistently achieved moderate learning gains across all variables, whereas the control group remained in the low improvement category. Critical thinking showed the highest normalized gain (60.81%), followed by creative thinking (59.09%) and communicative skills (54.65%), confirming the effectiveness of the intervention in promoting students' higher-order competencies.

Table 4. MANOVA Results

Multivariate Test	Value	F	p-value	Partial η²
Pillai's Trace	0.675	44.285	<0.001	0.675
Wilks' Lambda	0.325	44.285	<0.001	0.675
Hotelling's Trace	2.076	44.285	<0.001	0.675
Roy's Largest Root	2.076	44.285	<0.001	0.675

The multivariate analysis revealed a statistically significant overall treatment effect on the combined dependent variables ($p < 0.001$). The partial eta squared value of 0.675 indicates a large multivariate effect size, suggesting that approximately two-thirds of the variance in students' higher-order thinking and communicative skills was attributable to the instructional treatment.

Table 5. Between-Subjects Effects

Dependent Variable	F	p-value	Partial η²	Effect Size
Critical Thinking	36.870	<0.001	0.358	Large
Creative Thinking	44.855	<0.001	0.405	Large
Communicative Skills	32.199	<0.001	0.328	Large

The between-subjects analysis confirmed significant treatment effects for each dependent variable individually ($p < 0.001$). Creative thinking exhibited the largest effect size ($\eta^2 = 0.405$), followed by critical thinking ($\eta^2 = 0.358$) and communicative skills ($\eta^2 = 0.328$). These findings indicate that the intervention consistently produced substantial improvements across all measured competencies.

Table 6. Students' Self-Efficacy after the Intervention

Dimension	Mean Range	Category
Magnitude	3.97–4.06	High
Generality	3.94–4.06	High
Strength	3.97–4.09	High

The self-efficacy questionnaire indicated high levels of perceived self-efficacy across all three dimensions. Students demonstrated strong confidence in completing challenging tasks, applying knowledge across various learning situations, and maintaining positive beliefs about their academic capabilities. These findings suggest that integrating self-efficacy reinforcement within the PBL model successfully fostered students' confidence throughout the learning process.

The findings demonstrate that Problem-Based Learning (PBL) integrated with self-efficacy reinforcement significantly enhanced students' critical thinking skills compared with conventional instruction. The experimental group achieved a significantly greater improvement than the control group, as reflected by a mean gain of 30.12 points, an N-Gain of 60.81% (moderate category), and a significant between-group difference ($t = 6.072$, $p < 0.001$). These findings indicate that engaging students in authentic problem-solving activities while strengthening their confidence encourages deeper cognitive processing and evidence-based reasoning. Within the PBL environment, students are required to identify problems, evaluate information, formulate arguments, and justify conclusions, all of which stimulate higher-order thinking processes. Simultaneously, self-efficacy reinforcement increases students' willingness to persist when facing complex learning tasks, thereby promoting more effective critical analysis. This finding supports the social cognitive theory proposed by Sedayu et al., (2024), which states that individuals with stronger self-efficacy demonstrate greater persistence, cognitive engagement, and problem-solving performance. The present findings are also consistent with previous studies reporting that PBL effectively promotes critical thinking by encouraging inquiry, collaborative learning, and reflective reasoning (Siregar et al., 2025; Xie et al., 2025).

The implementation of PBL with self-efficacy reinforcement also produced a significant improvement in creative thinking skills. Students in the experimental class demonstrated a 29.65-point increase, significantly outperforming the control group ($t = 6.697$, $p < 0.001$), while achieving an N-Gain of 59.09%, compared with only 13.26% in the control class. These results suggest that learning activities emphasizing authentic problems and collaborative investigation provide opportunities for students to generate multiple ideas, explore alternative

solutions, and elaborate innovative responses. The self-efficacy component further strengthens students' confidence to express original ideas without fear of making mistakes, thereby fostering cognitive flexibility and originality. According to Qadeer, (2026), creative thinking develops more effectively when learners are encouraged to generate diverse solutions in supportive learning environments. Likewise, Nofriyandi et al., (2024) argue that students' creative performance depends not only on cognitive ability but also on their confidence in applying creative ideas. Therefore, integrating self-efficacy reinforcement into PBL provides both cognitive and motivational support that facilitates creative thinking during classroom learning.

A similar pattern was observed for communicative skills, where students taught through PBL integrated with self-efficacy reinforcement demonstrated significantly better performance than those receiving conventional instruction. The experimental group recorded a 29.53-point improvement, an N-Gain of 54.65%, and a statistically significant posttest difference ($t = 5.674$, $p < 0.001$). These findings indicate that collaborative discussions, group investigations, classroom presentations, and reflective dialogue embedded in PBL provide authentic opportunities for students to articulate ideas, defend arguments, and communicate solutions effectively. Reinforcing self-efficacy further increases students' confidence in public speaking and classroom interaction, enabling them to participate more actively in academic discourse (Siregar, 2025b). These findings align with Vygotsky's social constructivist perspective, which emphasizes that knowledge develops through social interaction and meaningful communication. Previous studies have similarly concluded that PBL enhances communication competence by promoting collaborative learning, active participation, and oral presentation skills (Al-Thani & Ahmad, 2025; Utama et al., 2025).

The multivariate findings further strengthen the effectiveness of the instructional model. The MANOVA analysis revealed a highly significant simultaneous effect across all dependent variables (Pillai's Trace = 0.675, $F = 44.285$, $p < 0.001$), indicating that the intervention improved critical thinking, creative thinking, and communicative skills concurrently rather than independently. Furthermore, the partial eta squared of 0.675 represents a large multivariate effect size, suggesting that approximately two-thirds of the variance in the combined learning outcomes was attributable to the instructional treatment. The univariate analyses also demonstrated substantial effect sizes for each competency, including critical thinking ($\eta^2 = 0.358$), creative thinking ($\eta^2 = 0.405$), and communicative skills ($\eta^2 = 0.328$). Among these, creative thinking exhibited the strongest treatment effect, indicating that combining authentic problem-solving with self-efficacy reinforcement particularly facilitates divergent thinking and idea generation. These findings support previous evidence suggesting that student-centered pedagogies integrating cognitive and motivational components generate broader educational benefits than instructional approaches focusing solely on knowledge acquisition (Ponsa & Wati, 2025; Šliogerienė et al., 2025; Yulianto et al., 2024).

An additional contribution of this study lies in the integration of self-efficacy reinforcement within the PBL framework. Students in the experimental class reported consistently high self-efficacy, with mean scores ranging from 3.94 to 4.09 across the dimensions of magnitude, generality, and strength, indicating strong confidence in solving learning tasks, collaborating with peers, and applying knowledge across learning contexts. These findings suggest that self-efficacy functions as an important psychological mechanism supporting students' cognitive engagement throughout the PBL process. Students who believe in their own capabilities tend to invest greater effort, persist longer when encountering difficulties, and actively participate in collaborative problem-solving, ultimately leading to improved higher-order thinking and communication performance. This finding reinforces Bandura's social cognitive theory that self-efficacy serves as a central determinant of learning behavior and academic achievement (Ekayana et al., 2024; Lestari et al., 2025; Putri et al., 2025). Overall, the present study extends previous PBL research by demonstrating that embedding systematic self-efficacy reinforcement within problem-based learning creates a more comprehensive instructional approach capable of simultaneously strengthening multiple twenty-first-century competencies required in Civic Education.

Conclusions

This study concludes that Problem-Based Learning (PBL) integrated with self-efficacy reinforcement effectively improves students' critical thinking, creative thinking, and communicative skills in Civic Education. Compared with conventional instruction, the integrated learning model produced significantly greater improvements across all three competencies, as evidenced by higher learning gains and significant multivariate effects. The findings also indicate that strengthening students' self-efficacy during the learning process enhances their confidence, active participation, and cognitive engagement in solving authentic problems. Therefore, integrating self-efficacy reinforcement into PBL represents an effective instructional strategy for fostering higher-order thinking and communication competencies, offering valuable pedagogical implications for implementing student-centered learning in secondary education.

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