

Deep learning-oriented problem-based learning to foster critical thinking in civic education in primary schools

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Abstract

How can civic education move beyond transmitting knowledge to cultivating the critical thinking young citizens need for democratic life? This study addresses that question by examining a deep learning-oriented problem-based learning (DL-PBL) model designed to develop critical thinking and support civic learning within primary Civic Education. Using a convergent mixed-methods design, we worked with 112 fourth-grade students from two primary schools in Palembang, South Sumatra, employing a quasi-experimental pre-test-post-test design with intact classes, complemented by classroom observations and students' reflective journals. Because the total-score distribution was non-normal, between-group differences were analysed using an independent-samples Mann-Whitney U test, which indicated a statistically significant difference in total critical-thinking scores between the two groups, $U = 0.000$, $z = -9.142$, $p < .001$, with a very large standardised effect size, $r = .864$. The five critical-thinking aspect scores showed high internal consistency (Cronbach's $\alpha = .888$), and descriptive results showed consistently higher achievement percentages in the DL-PBL group across all assessed aspects. Qualitative findings revealed meaningful engagement with local civic issues, collaborative inquiry, reflective thinking, and active participation throughout the learning process. Together, these findings suggest that DL-PBL offers a promising instructional framework for connecting critical thinking with civic reasoning, Pancasila values, and community-based learning, providing a practical pathway for strengthening civic education in primary schools.

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Introduction

Civic education plays an important role in preparing young people to participate actively in democratic life and respond to increasingly complex social issues. In this context, students need not only to understand civic knowledge but also to develop the ability to analyse information, consider different perspectives, and make reasoned judgements about issues affecting their communities. These abilities are closely related to the development of critical thinking, which is considered an important capacity for students to deal with complex problems



and make informed decisions. The development of critical thinking has therefore become an important concern in contemporary education, particularly as students are expected to respond to social and global challenges through higher-order thinking (Yanti & Thohir, 2024).

In the context of education in Indonesia, the Independent Curriculum policy emphasises developing critical thinking across subjects, including Pancasila Education. Pancasila Education has a broader role than transmitting knowledge about Pancasila because it also provides a context for developing students' understanding, attitudes, and participation as citizens. Civic and citizenship education frameworks similarly view civic learning as involving knowledge, attitudes, dispositions, and engagement. In the context of Pancasila Education, these dimensions can be developed through learning activities that connect Pancasila values to social realities and problems students encounter in their communities. However, classroom learning is still often dominated by lecture-based strategies and memorisation exercises, thereby limiting opportunities for authentic analysis and problem-solving. A recent study on Civic Education in primary schools shows low student involvement in discussions, arguments, and joint decision-making, with implications for the limited development of critical thinking and cooperation skills in the context of citizenship (Afikah et al., 2023).

Problem-Based Learning (PBL) has been recognised as one of the learning models that effectively develops students' critical thinking and problem-solving skills. Recent meta-analyses show that PBL significantly improves primary school students' critical thinking skills through active involvement in contextual problem-solving (Setyawan et al., 2026; Yu & Zin, 2023). In Pancasila Education, contextual problems can also help students connect Pancasila values with issues in their local communities. Such learning requires students to examine information, consider different perspectives, discuss possible responses, and make reasoned decisions about problems of shared concern. These activities support the development of civic dispositions and democratic participation because students are expected not only to understand an issue but also to consider how their knowledge and values can be applied to respond to problems in their community. A systematic study of critical-thinking-oriented PBL further confirms the importance of task design that requires in-depth analysis, argument evaluation, and solution synthesis (Savery, 2006; Yu & Zin, 2023). Therefore, PBL provides a relevant learning structure for connecting critical thinking with the contextual and value-oriented purposes of Pancasila Education.

Deep learning provides an additional perspective for strengthening the quality of learning experiences in Pancasila Education. It emphasises meaningful, mindful, and joyful learning, allowing students to connect new knowledge with prior experiences, engage consciously in learning activities, and experience learning as relevant to their lives (Ain et al., 2025; Yanti & Thohir, 2024). In the context of civic learning, these principles are important because students encounter civic issues not only as academic content but also as part of their social environment. Civic and citizenship education is concerned not only with students' acquisition of civic knowledge but also with the development of attitudes, dispositions, and engagement that enable them to participate in social and democratic life. Meaningful learning can help students connect Pancasila values with real problems, while mindful learning encourages students to examine information and their own reasoning during the learning process. Joyful learning can further support students' active involvement in discussions, collaboration, and problem-solving. Previous studies have applied deep learning principles in various subject areas; however, their application in Pancasila Education, particularly through problem-based learning in primary schools, remains limited (Ain et al., 2025; Yanti & Thohir, 2024). Therefore, integrating deep learning principles into PBL may provide a learning environment that connects critical thinking with contextual civic issues and Pancasila values.

The deep learning pedagogical approach emphasises mindful, meaningful, and joyful learning, which can encourage students to build deep understanding and connect knowledge to their real experiences (Feriyanto & Anjariyah, 2024; Fullan et al., 2018; Sliwka et al., 2024).

Based on this gap, this study developed and examined a deep learning-oriented problem-based learning (DL-PBL) model for Pancasila education in primary schools. The model integrates five PBL stages with the principles of meaningful, mindful, and joyful learning and uses local civic and social issues as the context for learning activities. Through this approach, students are encouraged to analyse problems, examine information, consider different perspectives, develop possible solutions, and reflect on their learning. This study aimed to examine the effectiveness of DL-PBL in fostering students' critical thinking and explore how the learning process supported meaningful, mindful, and joyful learning in Pancasila Education. This study contributes to developing a learning approach that connects critical thinking with contextual civic issues and Pancasila values, while giving students opportunities to engage actively in learning activities relevant to their social environment.

Method

Research Design and Data Types

This study employs a convergent mixed-methods design, combining a quasi-experimental quantitative method with a qualitative process evaluation method (Creswell & Plano Clark, 2018; Fetter et al., 2013). The quantitative component uses a pre-test-post-test control-group design with intact classes and purposive sampling. This design suits assessing an intervention's effectiveness when random assignment is not feasible. Because the groups were not randomly assigned, causal claims are limited, and the findings should be interpreted with caution. Purposive sampling based on school willingness and class homogeneity limits the generalisability of the findings beyond the participating schools and contexts.

The qualitative component consists of structured observations and analysis of students' reflective journals to evaluate the appropriateness and quality of the learning model's implementation across five dimensions: authenticity of problems, depth of collaborative inquiry, reflective engagement, adjustment of cognitive challenges, and enthusiastic participation (Lawson et al., 2023; Savery, 2006).

The research data comprise three types:

- Students' critical thinking scores (pre-test and post-test).
- Data on the assessment of the learning process by the teacher via an observation rubric.
- Data from students' reflective journals describing their learning experiences.

Quantitative data measured changes in critical thinking skills across groups, while qualitative data assessed the quality of the learning process and corroborated the quantitative findings through triangulation (Miles & Huberman, 1994).

Deep Learning-Oriented Problem-Based Learning Model

The DL-PBL model combines PBL with deep learning principles to support critical thinking in Pancasila Education. PBL provides a structure for learning through authentic problems, investigation, collaboration, solution development, and reflection (Savery, 2006; Yu & Zin, 2023), while deep learning emphasises meaningful, mindful, and joyful learning experiences (Ain et al., 2025; Yanti & Thohir, 2024). In Pancasila Education, these processes are contextualised through social and civic issues that allow students to examine problems, consider different perspectives, and relate their reasoning to Pancasila values.

The DL-PBL model developed in this study integrates the five phases of PBL (problem orientation and knowledge activation, collaborative inquiry, solution development, solution presentation and dialogue, and reflection) with the three principles of deep learning: meaningful, mindful, and joyful learning (Nafi'ah & Faruq, 2025). Each phase is designed to facilitate high-level cognitive engagement (C4–C6) whilst strengthening the connection

between the subject matter and students' real-life experiences, as well as self-regulation in the thinking process (Lawson et al., 2023).

1. Phase 1: Problem Orientation (Meaningful and Mindful) – students are presented with authentic social problems rooted in the local context, such as environmental conflicts, social inequalities, or dilemmas regarding the use of community resources. The problems are structured with sufficient complexity to prevent simplistic solutions and require analysis, evaluation, and creativity. The problems are also connected to Pancasila values, allowing students to examine social issues, consider different perspectives, and relate their reasoning to principles of living together in society.
2. Phase 2: Collaborative Inquiry and Evidence Gathering (Joyful): Heterogeneous groups (4–5 students) conduct structured inquiry using primary sources, local data, and community information. Gamification elements (challenge cards, investigation badges, peer recognition) are used to maintain motivation and enjoyable engagement throughout the inquiry process. The inquiry also encourages students to examine evidence related to the civic issue and discuss different perspectives before developing their solutions.
3. Phase 3: Analysis, Evaluation, and Solution Development (Core of Critical Thinking): Students apply analytical frameworks, such as cause-and-effect mapping and multi-stakeholder matrices, to evaluate evidence, identify root causes, and devise well-reasoned solutions mapped to the cognitive operations C4 (analysis), C5 (evaluation), and C6 (creation). Students consider the solutions in relation to the civic issue and Pancasila values, justifying their reasoning based on the evidence examined.
4. Phase 4: Solution Presentation and Dialogue (Meaningful + Mindful): Groups present their solutions in a structured classroom forum; the teacher facilitates a question-and-answer session between groups and Socratic dialogue to encourage students to defend, revise, and synthesise their reasoning. The dialogue also provides opportunities for students to consider different perspectives on the civic issue and relate their arguments to relevant Pancasila values.
5. Phase 5: Collaborative Reflection and Transfer (Synthesis of deep learning): Students write reflective journals answering three questions: the significance of the issue for the community (meaningful), changes in their thinking during the process (mindful), and the most valuable moment in the inquiry and the reasons for it (joyful). The reflection also encourages students to consider how the knowledge and reasoning developed through the inquiry relate to similar issues in their community.

Table 1 summarises the phase structure, principles of deep learning, levels of critical thinking, and key activities, enabling readers to see the operational relationship between the model and the development of critical thinking in civic education.

Table 1.

Problem-Based Learning Model Based on deep learning: Phase Structure, deep learning Orientation, and Alignment with Critical Thinking

Phase	Problem-Based Learning Syntax	Deep Learning Principles	Level of Critical Thinking	Main Activities
1	Problem Orientation and Knowledge Activation	Meaningful + Mindful	C4–C6	Presentation and orientation of authentic civic and social problems; KWL+ chart, metacognitive analysis mapping
2	Collaborative Inquiry	Joyful	C4–C5	Group evidence gathering, data analysis, and consideration of different perspectives

Phase	Problem-Based Learning Syntax	Deep Learning Principles	Level of Critical Thinking	Main Activities
3	Solution Development	Meaningful	C5–C6	Evaluation matrix, solution design related to the civic issue
4	Presentation & Dialogue	Mindful + Joyful	C5–C6	Forum, Q&A amongst classmates, and discussion of different perspectives
5	Reflection and Application	Meaningful	C4–C6	Structured reflection journal, and connection to community issues

Participants

The research participants were 112 fourth-grade students at two primary schools in Palembang, South Sumatra: SD Az-Zahrah Palembang and SDN 150 Palembang. The sample was selected using purposive sampling based on the schools' willingness to participate and the homogeneity of class characteristics. The experimental group ($n = 56$) received instruction using the DL-PBL model over four sessions, while the control group ($n = 56$) received conventional, teacher-centred instruction using standard textbooks in Civic Education. This quasi-experimental approach, involving control and experimental classes within the natural context of primary schools, aligns with research on the effectiveness of learning models in civic education.

Instruments and Data Collection

Three instruments were used in this study:

1. Critical Thinking Instrument

This instrument yields five critical-thinking aspect scores (A1–A5): providing a simple explanation, building basic skills, drawing conclusions, providing a more detailed explanation, and devising strategies and tactics. Content validation was carried out through an expert review by two lecturers in Pancasila and Citizenship Education and two primary school teachers, who assessed the alignment of the items with the indicators and context of civic education, in accordance with the critical thinking test development procedures used in the PBL meta-analysis study. Reliability analysis using Cronbach's alpha showed $\alpha = .888$ with 5 items, indicating good internal consistency. The corrected item-total correlations ranged from .706 to .769.

2. DL-PBL Process Evaluation Rubric

Four class teachers used this rubric to assess the quality of the DL-PBL model's implementation across five dimensions: problem authenticity, depth of collaborative inquiry, reflective engagement, adjustment of cognitive challenges, and enthusiastic participation. Each indicator was assessed using a 1–5 Likert scale; the teachers' scores were averaged to produce a process quality index per session (Savery, 2006). This approach enables assessment of the learning process's reliability and the consistency of the model's application in the experimental classes (Biggs & Tang, 2011).

3. Students' Reflective Journals

Reflective journals were collected from students in the experimental class at the end of each learning session. Students were asked to write about the significance of the problem to the community, changes in their thinking, and the most enjoyable aspects of the learning process. The journal data were analysed using the three principles of deep learning (meaningful, mindful, joyful) and thematic analysis to identify patterns in students' engagement with meaning, metacognition, and affect.

Data collection took place over four consecutive sessions. A critical thinking pre-test was administered before the intervention, while a post-test was administered after all DL-PBL or conventional learning sessions were completed. Process observations and the completion of rubrics were carried out at each session in both classes, whilst reflective journals were collected only from the experimental class.

Data Analysis and Visualisation

Quantitative data in the form of critical thinking scores were analysed using SPSS. The analysis followed several main steps. First, descriptive statistics were computed, including mean, standard deviation, median, minimum, and maximum values. Second, normality was tested using the Kolmogorov–Smirnov and Shapiro–Wilk tests. Because the distributional assumption was not met—the overall sample deviated significantly from normality—the independent-samples Mann–Whitney U test was used as a non-parametric alternative to compare post-test scores between the experimental and control groups. Third, we assessed the reliability of the critical thinking aspect scores using Cronbach’s alpha. We calculated effect sizes as $r (|z|/\sqrt{N})$ and as the rank-biserial correlation to evaluate the practical magnitude of the intervention effect. We analysed qualitative process data from the observation rubric and students’ reflective journals descriptively and thematically. Triangulation across test results, process rubrics, and reflective journals strengthened the validity of the findings on the effectiveness and quality of DL-PBL implementation in civic education.

The process rubric data from teachers were analysed descriptively to identify patterns of improvement in DL-PBL implementation quality across sessions, focusing on the authenticity of problems, the depth of inquiry, and students’ reflective engagement. The study analysed data from students’ reflective journals using thematic analysis, grouping students’ statements into three categories of deep learning: meaningful, mindful, and joyful learning. Triangulation among test results, process rubrics, and reflective journals strengthened the validity of the findings on the effectiveness and quality of DL-PBL implementation in civic education.

Results and Discussion

The following presents empirical findings from the research and discusses how the DL-PBL model affects students’ critical thinking skills and the quality of the learning process in Civic Education. The results and discussion are arranged into three parts: (1) quantitative results of increasing critical thinking: pre-test and post-test, and critical thinking, (2) findings of the DL-PBL implementation process in the classroom, and at the end of the discussion, the pedagogical implications for the Independent Curriculum and Civic Education are explained. In closing, the study presents limitations and suggestions for further research, as well as pedagogical implications for the Independent Curriculum and Civic Education.

Quantitative Critical Thinking Outcomes

Table 2.

Normality Test

Group	Kolmogorov–Smirnov			Shapiro–Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Total	.194	112	.000	.891	112	.000

The normality test showed that the overall sample deviated significantly from normality (Kolmogorov–Smirnov statistic = .194, $df = 112$, $p < .001$; Shapiro–Wilk statistic = .891, $df = 112$, $p < .001$). Therefore, we used the non-parametric Mann–Whitney U test for the group comparison. The overall mean critical thinking score was 45.20 ($SD = 10.363$), with a median of 46.50, a minimum of 27, and a maximum of 64.

Table 3.*Mann-Whitney U Test*

Statistic	Value
Total N	112
Mann-Whitney U	.000
Wilcoxon W	1596.000
Test Statistic	.000
Standard Error	171.511
Standardised Test Statistic (Z)	−9.142
Asymp. Sig. (2-tailed)	.000

The Mann-Whitney U test showed a statistically significant difference between the experimental and control groups ($U = .000$; $W = 1596.000$; $Z = -9.142$; $p < .001$). Therefore, the null hypothesis stating that the distribution of critical thinking scores is the same across groups was rejected. The experimental group scored significantly higher than the control group. The effect size was very large ($r = .864$, calculated as $|z|/\sqrt{N}$), and the rank-biserial correlation was 1.00, indicating complete separation between the two groups. This shows that the DL-PBL model not only produced a statistically significant difference but also had a very large practical effect on students' critical thinking skills.

Critical Thinking

To assess the quantitative effectiveness of the DL-PBL model on students' critical thinking skills, score analysis was conducted on five aspects of critical thinking in the experimental class and the control class as presented in Table 4 below:

Table 4.*Results of the Evaluation of Critical Thinking Levels Among Students in the Experimental and Control Classes*

Critical Thinking Aspects	Experimental Class			Control Class		
	Acquisition Score	Average	Percentage (%)	Acquisition Score	Average	Percentage (%)
Provide a Simple Explanation	755	0.8988	89.88	460	0.5476	54.76
Building Basic Skills	739	0.8797	87.97	465	0.5535	55.35
Summing up	756	0.9	90	511	0.6083	60.83
Provide Further Explanation	496	0.8857	88.57	297	0.5303	53.03
Setting Strategies and Tactics	473	0.8446	84.46	311	0.5553	55.53

Based on the assessment results in Table 4 above, the experimental and control classes differed significantly across all assessed aspects. The experimental class achieved higher percentages on each indicator than the control class. These results indicate that implementing the DL-PBL model positively affects students' critical thinking skills, consistent with findings that metacognitive self-regulation skills develop gradually through repeated reflective practice.

Table 4 presents descriptive statistics for critical thinking scores in both groups before and after the intervention. The experimental group showed a significant increase in scores. This test was used to determine the effect of applying the DL-PBL model on critical thinking skills in Civic Education for fourth-grade primary school students.

If visualised in the form of a diagram, the results of the Evaluation of Critical Thinking Levels Among Students in the Experimental and Control Classes can be seen in the following Figure 1:

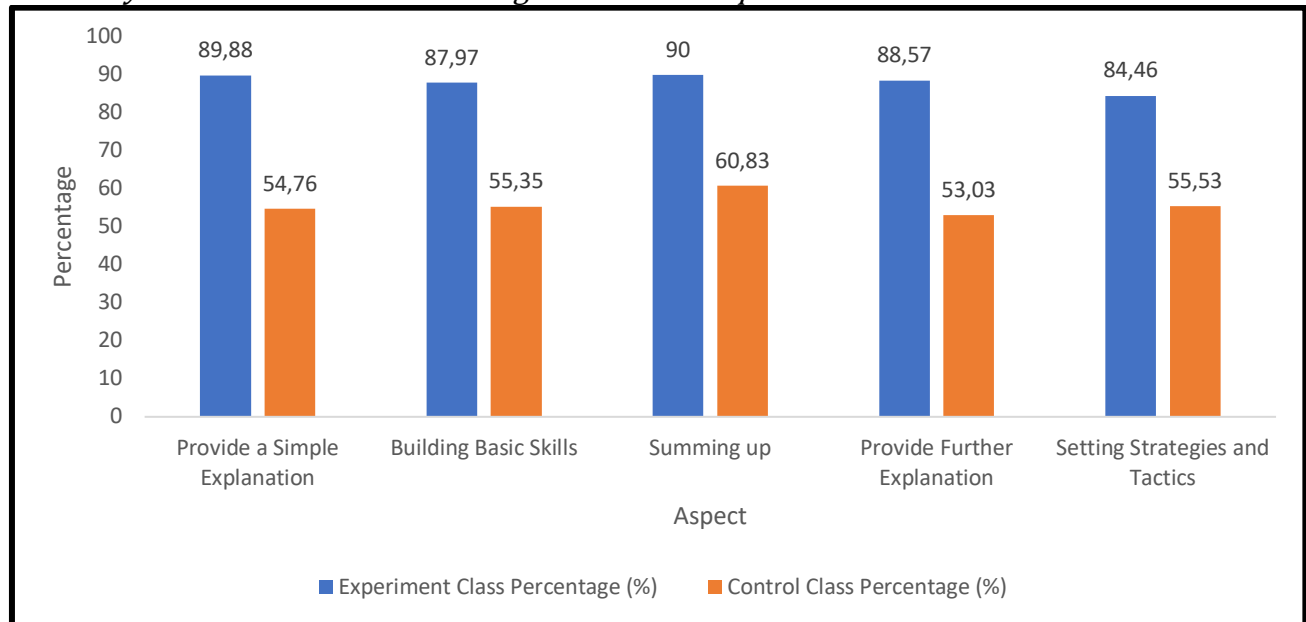
Figure 1.*Summary of students' critical thinking levels in the experimental and control classes*

Figure 1 shows students' critical thinking levels across five aspects in the experimental and control classes: providing simple explanations, building basic skills, drawing conclusions, providing follow-up explanations, and devising strategies and tactics. In the experimental class, achievement ranged from 84.46% to 90%, while in the control class it ranged from 53.03% to 60.83%. Figure 1 reinforces this distinction visually: the experiment-class curve is consistently well above the control-class curve for all aspects of critical thinking. These findings show that the implementation of DL-PBL provides an even and significant improvement in all dimensions of critical thinking compared to conventional textbook-based learning.

Based on the findings from this process evaluation, the results provide detailed insights into the mechanisms employed by deep learning-supported PBL to foster higher-order thinking, complementing the quantitative results with a deeper understanding of how critical thinking develops within this model. Progressive improvement was observed across all five dimensions of the process, particularly a striking trend in the depth of collaborative inquiry and the quality of reflective engagement from the initial sessions through to the final sessions. This is consistent with the social constructivist account of cognitive development, which predicts that higher-order mental functions emerge through repeated social interaction and are gradually internalised as autonomous cognitive capacities (Setyawan et al., 2026; Wibowo et al., 2022).

Qualitative findings of the DL-PBL implementation process

A thematic analysis of the reflective journals reinforced the teachers' assessments. Over four sessions, 87% of journal entries in the experimental group showed evidence of meaningful engagement (linking the subject matter to personal experiences), 79% demonstrated mindful processing (explicit metacognitive comments regarding their reasoning or uncertainties), and 91% revealed a positive affective orientation towards the learning activities (an indicator of joyful learning). A representative excerpt from a student's journal was: 'I had never thought about why some of our cultures have become extinct. Now, having researched this together, I understand the causes and want to preserve my local culture.' Responses such as this, which integrate affective engagement (joyful), the connection between content and context (meaningful), and self-reflective reasoning (mindful), exemplify the deep learning orientation fostered by this model.

The analysis of the reflective journals enriches our understanding of this process by revealing how these three deep learning principles integrate at the individual cognitive level.

The finding that 87% of journal entries demonstrated meaningful engagement is particularly striking: this indicates that linking issues in real lives to the realities of the local community is effective in activating prior knowledge rooted in experiences and in generating genuine cognitive connections, which distinguish deep learning from surface learning (Yanti & Thohir, 2024). The students' reflections also show that local social and cultural issues provided a context for considering why community problems occur and how to address them. The progressive improvement in indicators of mindful processing throughout the sessions is consistent with literature showing that metacognitive capacity can be developed through structured reflective practice (Odom et al., 2026; Strobel & van Barneveld, 2009).

Its advantages over conventional teaching stem from several complementary mechanisms. Cognitively, authentic, unstructured problems create a productive cognitive imbalance that motivates higher-level conceptual reorganisation (Barrouillet, 2015). Socially, collaborative inquiry guides learners with more knowledge, fostering cognitive growth aligned with the Zone of Proximal Development. Pedagogically, a meaningful, mindful, and enjoyable orientation ensures that the deep learning approach provides a framework of intrinsic motivation that supports learners in meeting the cognitive demands of authentic inquiry (Ariyani et al., 2025; Ceballos et al., 2026). Embedding problems within students' social reality also increases the relevance of learning and connects critical thinking to issues in their communities (Davidsen & Bernhard, 2026).

Furthermore, from an ecological perspective, embedding problems within learners' social reality maximises motivational relevance and activates prior knowledge factors identified in the deep learning literature as prerequisites for meaningful understanding (Davidsen & Bernhard, 2026). The teacher assessment process rubric supports these quantitative findings. From the first to the fourth session, the process index for problem authenticity, inquiry depth, and reflective engagement in the experimental class continued to increase, while the control class remained stable at a moderate level. This shows that DL-PBL succeeds in building a challenging yet supportive learning environment, so that students are encouraged to move from surface understanding to deeper understanding, in line with the characteristics of effective problem-based learning (Savery, 2006; Setyawan et al., 2026).

Thematic analysis of students' reflective journals clarifies the deep learning mechanism in this model. Over the course of four sessions, 87% of journal entries demonstrated meaningful learning, with students associating the issues learned with personal experiences and community realities; 79% demonstrated mindful learning through explicit metacognitive comments about the way of thinking, doubt, and strategies used; and 91% reflected joyful learning through expressing enthusiasm and pride in the work of the group. This pattern aligns with constructivist studies that affirm that positive emotional engagement, metacognitive reflection, and contextual relevance are important prerequisites for the sustainable development of critical thinking (Ain et al., 2025). The connection between learning issues and community realities also shows how contextual civic issues can provide a meaningful setting for students to apply critical thinking.

Process findings suggest that DL-PBL develops critical thinking through a combination of cognitive demands, social support, and motivational orientation. Cognitively, the authentic issues raised create a productive imbalance that encourages students to reorganise concepts at a higher level (Maxnun et al., 2024; Setyawan et al., 2026). Socially, heterogeneous group work provides peer support and teacher guidance, while gamification, peer recognition, and opportunities for public presentation support students' engagement with complex analysis and evaluation (Odom et al., 2026). Students' reflective journals further show that the relevance of the problems, group support, and classroom dialogue made them more comfortable questioning different views and revising their own opinions. These processes support critical thinking in the context of citizenship because students engage with social issues, consider different perspectives, and reflect on their reasoning.

On the motivational side, the joyful learning elements—gamification, peer recognition, and opportunities for public presentation—keep students engaged even when tasks require complex analysis and evaluation. This aligns with findings on intrinsic motivation, which indicate that autonomy, competence, and social connectedness strengthen students' tendency to engage in critical thinking tasks (Odom et al., 2026). Students' reflective journals show that the combination of problem relevance, group support, and classroom dialogue makes them more comfortable making excuses, questioning others' views, and revising their own opinions—three key indicators of critical thinking in the context of citizenship.

Overall, this study's findings strengthen and expand the literature on PBL and deep learning. Previous meta-analyses and systematic studies show that PBL improves critical thinking and learning outcomes in various subjects (Ceballos et al., 2026; Davidsen & Bernhard, 2026; Doğantan et al., 2026; Strobel & van Barneveld, 2009). However, most of these studies focus on science and have not explicitly integrated deep learning principles into primary school civic education. This study adds evidence that when PBL is designed with a meaningful, mindful, and joyful orientation, the model not only improves critical thinking test scores but also strengthens student engagement with local civic issues and encourages sustainable metacognitive reflection.

Pedagogical implications for the Independent Curriculum and Civic Education

The Independent Curriculum requires student-centred, differentiated, and contextually oriented learning aligned with the Pancasila Student Profile, which emphasises critical, creative, and noble character. The findings suggest that DL-PBL aligns with these demands: it positions students as the primary agents in identifying, investigating, and resolving problems; allows teachers to adjust problem complexity to students' readiness levels; and connects citizenship issues to the local realities they encounter in daily life.

For Civic Education teachers in primary schools, DL-PBL provides a practical framework for designing learning that is at once the following: developing critical thinking through structured analysis, evaluation, and creation tasks; supporting students' engagement with social issues through class discussions and problem-based projects; and maintaining motivation and enjoyment in learning through meaningful collaborative and reflective activities. Thus, this study not only answers the research question regarding the effectiveness of DL-PBL on critical thinking but also provides an empirical and pedagogical foundation for developing civic education learning practices in accordance with the vision of the Independent Curriculum.

In the realm of education for democratic citizenship, classroom practices that encourage students to examine and respond critically to social and democratic issues are important for developing meaningful civic learning. The findings of this study provide an example of how DL-PBL can support such learning by linking civic issues to students' local contexts, providing a clear inquiry structure, and facilitating directed reflection. Through these processes, students can apply critical thinking to social issues while considering different perspectives and the relevance of Pancasila values to their community.

Limitations and Directions for Future Research

Although this study's findings provide strong evidence of DL-PBL's effectiveness in developing critical thinking among primary school students in Pancasila Education, some limitations remain. First, the quasi-experimental design with two schools in one city limits the generalisability of the findings to more diverse contexts, both in terms of student characteristics and school culture. Future studies should include more schools with diverse socio-cultural backgrounds, including rural and urban areas, to test the consistency of this model's effectiveness (Wulandari et al., 2018). Second, this study measured critical thinking through written tests and journal analysis within a relatively short intervention period. The instrument assessed general critical thinking within a civic context rather than substantive civic

reasoning, such as evaluating public issues, the common good, or civic judgement. Future research could therefore develop domain-specific instruments to examine civic reasoning more directly and investigate its development through longitudinal designs and authentic contexts, such as community-based projects or school-based civic action. In addition, moderation variables such as teacher experience, school leadership, class size, and technology integration have not been thoroughly examined. Future studies could examine how these factors affect the quality of DL-PBL implementation and identify the school ecosystem conditions that best support deep learning-oriented civic learning (Sliwka et al., 2024).

This study provides empirical evidence of DL-PBL's potential contribution to critical thinking in primary students' Civic Education. However, the quasi-experimental design, intact classes, and participation of only two schools in one city suggest that future studies should examine the model across broader socio-cultural and educational contexts. The intervention was conducted over a relatively short period and used total critical-thinking scores, classroom observations, and reflective journals. Future research should employ longer-term, performance-based, and community-oriented assessments to examine the development of civic reasoning and participation beyond the classroom.

The Mann-Whitney U test indicated a significant difference between the two groups, $U = 0.000$, $z = -9.142$, $p < .001$, with a standardised effect size of $r = .864$. Future studies should report complete group-specific statistics and confirm the direction of the difference based on the group coding. The reliability analysis of the five analysed item or aspect scores produced Cronbach's $\alpha = .888$; further research should examine the complete instrument and report inter-rater agreement for teacher-observation scores. DL-PBL offers a promising framework for connecting authentic community issues, collaborative inquiry, structured dialogue, reflection, critical thinking, Pancasila values, and civic responsibility. Future studies should investigate its implementation across diverse settings and its longer-term contribution to civic learning.

Conclusion

This study indicates that the deep learning-oriented problem-based learning (DL-PBL) model provides a promising approach for developing critical thinking in primary Civic Education. The Mann-Whitney U analysis showed a statistically significant difference in total critical-thinking scores between the two groups, $U = 0.000$, $z = -9.142$, $p < .001$, with a very large standardised effect size, $r = .864$. The available five-item or aspect-level reliability analysis also showed high internal consistency, with Cronbach's α of .888. The qualitative findings further indicated that DL-PBL encouraged meaningful engagement with local community issues, collaborative inquiry, reflective thinking, dialogue, and active participation. By integrating authentic problems, evidence gathering, solution development, structured discussion, and reflection, DL-PBL provides a practical framework for linking critical thinking with civic reasoning, Pancasila values, responsibility, and the common good. The findings support using DL-PBL as a contextually relevant learning approach in primary Civic Education. Further studies may extend its application across diverse school contexts and examine its contribution to students' civic reasoning and participation over a longer period.

Authors' contributions

Umi Chotimah: Conceptualisation, methodology, funding acquisition, project administration, supervision, writing – original draft, and writing – review and editing. Sulkipani: Investigation, data curation, formal analysis, visualisation, writing – original draft, and writing – review and editing. Both authors read and approved the final manuscript.

Competing interests

The authors do not have any potential conflicts of interest to disclose.

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Ethics Approval

The researchers obtained permission to conduct the study from the principals and classroom teachers of the participating schools. Participation was voluntary, and the anonymity and confidentiality of the participants' data were protected throughout the research process.

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