

The PBL materials integrated with critical thinking skills in improving EFL learners' reading comprehension and linguistic awareness

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ABSTRACT

This study investigates the effectiveness of problem-based learning (PBL) materials integrated with critical thinking skills in enhancing English as a Foreign Language (EFL) learners' reading comprehension and linguistic awareness. Employing a mixed-method concurrent embedded design, the research involved 75 senior high school students in Central Lombok, Indonesia, divided into experimental and control groups. The experimental group received PBL-based instruction, while the control group was taught using non PBL instruction. Quantitative data were collected through pre- and post-tests on reading comprehension and linguistic awareness, complemented by a critical thinking assessment. Qualitative data were obtained from learner interviews to capture perceptions and experiences. The results revealed that the experimental group demonstrated significant improvements in both reading comprehension and linguistic awareness compared to the control group. Statistical analyses, including t-tests and ANOVA, confirmed the positive impact of integrating PBL with critical thinking, with reading comprehension showing greater gains than linguistic awareness. Qualitative findings further highlighted that students valued the collaborative, problem-solving nature of PBL, which fostered deeper engagement with texts and encouraged reflection. However, while improvements in critical thinking were evident, they were relatively modest, suggesting the need for explicit scaffolding of higher-order reasoning within the PBL framework. The findings confirm that PBL integrated with critical thinking constitutes an effective instructional model for promoting EFL learners' linguistic and cognitive development, offering valuable implications for teachers, curriculum designers, and policymakers seeking to foster meaningful, student-centered language learning.

Keywords: Critical thinking skills; EFL instruction; linguistic awareness; problem-based learning; reading comprehension

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INTRODUCTION

English as a Foreign Language (EFL) education, reading comprehension is a critical skill that learners are expected to master (Taherkhani & Moradi, 2022; Villanueva, 2022). Proficient reading comprehension not only allows learners to access a wide range of academic knowledge but also empowers them to think critically and express their thoughts with clarity and confidence (Kavani & Amjadiparvar, 2018; Mohammadi et al., 2020). Consequently, fostering reading comprehension has become a primary objective in English language education institutions and schools. EFL teachers, curriculum designers, and national educational authorities must work collaboratively to establish rich reading environments and implement effective instructional strategies that support learners in becoming competent, independent, and reflective readers (Haerazi et al., 2019; Haerazi & Irawan, 2020; Suci et al., 2023). Reading comprehension involves more than simply recognizing and decoding written words (Habibi et al., 2022). It is a complex, active process through which readers construct meaning by integrating textual information with prior knowledge, making connections, and drawing inferences (Asnawi et al., 2025; Asrimawati et al., 2024). This process encompasses various cognitive and linguistic components, including vocabulary acquisition, grammatical understanding, background knowledge, the identification of main ideas and supporting details, as well as the ability to analyze text structure (Dolba et al., 2022; Toprak & Cakir, 2021). Successful comprehension, therefore, depends on the reader's capacity to engage with these elements in an integrated and strategic manner.

One of the fundamental factors influencing the success of reading comprehension is learners' level of linguistic awareness. Linguistic awareness refers to an individual's ability to consciously reflect on and manipulate the structural components of language (Suratullah et al., 2023; Vaahtoranta et al., 2021), such as phonology (sound patterns), morphology (word formation), syntax (sentence structure), semantics (meaning of words and sentences), and pragmatics (language use in context). This awareness enables learners to decode text accurately, interpret sentence-level meaning, and comprehend extended discourse with coherence (Firman et al., 2021; Naqsyabandiyah & Dehghanitafti, 2023). Therefore, the development of linguistic awareness should be prioritized in EFL reading instruction, as it underpins the foundational skills necessary for understanding and interpreting written texts effectively.

To improve learners' reading comprehension and linguistic awareness, it is crucial to provide teaching materials and instructional strategies that are responsive to learners' needs, proficiency levels, and learning preferences (Haerazi et al., 2023, 2021). One promising approach is Problem-based learning (PBL), a student-centered instructional model that places learning within the context of real-world problem-solving. In PBL, learners engage with texts purposefully, aiming to gather information and insights needed to address complex issues. This intentional approach to reading encourages deeper cognitive engagement (Fitriyah et al., 2024; Pitorini et al., 2024), as learners must identify key ideas, connect textual information to problem contexts, and synthesize content meaningfully.

Moreover, PBL fosters collaborative learning through group discussions and peer

interaction (Ikawati & Pohan, 2023; Mustafa et al., 2024). These social processes allow learners to negotiate meaning, clarify misunderstandings, and refine their interpretations, thereby enhancing both comprehension and linguistic awareness development (Alquraishy et al., 2020; Girma et al., 2025). As learners work through real-life problems, they are also prompted to practice higher-order thinking skills such as analyzing, evaluating, and inferring—core components of advanced reading proficiency (Azzalini, 2023; Haerazi et al., 2020).

Given the educational benefits of PBL, the novelty of the study lies on the integration of problem-based learning with critical thinking skills to enhance EFL learners' reading comprehension and linguistic awareness in the form of teaching materials development. The aim of this study is to investigate the effectiveness of problem-based learning materials integrated with critical thinking skills in improving learners' reading comprehension and linguistic awareness. To achieve this aim, the study formulates the following research questions; (1) How effective are problem-based learning materials integrated with critical thinking skills in improving EFL learners' reading comprehension and linguistic awareness? (2) What are the EFL learners' responses in implementing the problem-based learning materials integrated with critical thinking skills in improving their reading comprehension and linguistic awareness?

METHODS

Research design

This study employed a mixed-method approach using a concurrent embedded design to investigate the effectiveness of problem-based learning materials integrated with critical thinking skills in enhancing EFL learners' reading comprehension and linguistic awareness. The use of this design allows for the simultaneous collection and analysis of both quantitative and qualitative data, providing a more comprehensive understanding of the research problem (Cohen et al., 2018). The quantitative component of the study follows an experimental design, specifically a pre-test and post-test control group design, to measure the impact of the intervention. In this phase, two groups of EFL learners—an experimental group receiving the PBL-based instruction and a control group receiving traditional instruction—are assessed on their reading comprehension and linguistic awareness before and after the intervention. The qualitative component, embedded within the quantitative phase, consists of learners' interviews that explore their perceptions, experiences, and attitudes toward the implementation of PBL materials integrated with critical thinking. This qualitative data help to interpret the results of the experiment. Together, this design ensures that the study addresses not only what changes occurred, but also how and why they happened.

Participants

The study was conducted at several senior high schools located in Central Lombok, West Nusa Tenggara, involving a total of 75 students as research participants. The selection of participants is based on several criteria, including English language proficiency levels, gender representation, and the accreditation status of the schools, ensuring a balanced and representative sample. The participants are aged between 17 and 18 years, a critical developmental stage where learners are transitioning into

adulthood and actively developing higher-order thinking skills, including critical thinking and analytical reasoning. This age group is particularly suitable for the study, as they are cognitively mature enough to engage with problem-based learning and apply critical thinking strategies in reading comprehension tasks. In conducting the research, several ethical considerations were strictly observed to protect the rights and well-being of the participants. Prior to the data collection, informed consent was obtained from all participants and, if necessary, from school authorities. Participation is voluntary, and students have the right to withdraw from the study at any time without penalty. Confidentiality and anonymity are maintained throughout the research process, and all data are used solely for academic purposes. The study also ensures that there is no harm, either physical or psychological, to participants during or after the research activities.

Instruments and data collection technique

The research instruments in this study include reading tests, linguistic awareness tests, critical thinking tests, and interview guidelines. Each instrument was carefully designed based on specific indicators that align with the skills being assessed. The reading test measures learners' abilities in identifying main ideas, recognizing supporting details, making inferences, understanding vocabulary in context, summarizing texts, analyzing text structure, evaluating content, and making meaningful connections. These indicators are essential for evaluating learners' comprehension and interpretation of written texts. The linguistic awareness test assesses students' understanding of various language components, including phonology, morphology, syntax, semantics, pragmatics, and metalinguistic awareness. These indicators reflect the learners' capacity to understand and manipulate language structures, which supports not only their reading comprehension but also their writing and overall communication skills. In the EFL context, linguistic awareness is foundational for achieving language proficiency. The critical thinking test evaluates learners' ability to analyze, evaluate, and synthesize information—skills crucial for forming reasoned judgments and solving problems. As a higher-order thinking skill, critical thinking is essential for academic success and deeper engagement with learning materials. Lastly, interview guidelines are used to gather qualitative insights into learners' experiences and perceptions of the learning process.

Data analysis

The data collected in this study undergo a comprehensive analysis using both quantitative and qualitative methods to ensure a robust understanding of the research findings. For the quantitative aspect, statistical analysis was employed, encompassing both descriptive and inferential statistics. Descriptive statistics, including the calculation of mean scores and standard deviations, are used to summarize and interpret the central tendency and variability of the data. This provides an overview of the participants' performance and responses. Inferential statistics, on the other hand, are utilized to examine relationships and test hypotheses. A t-test analysis was conducted to determine whether there is a statistically significant difference in the reading comprehension and linguistic awareness of EFL learners who are exposed to problem-based learning materials integrated with critical thinking skills, compared to those who are not. Furthermore, an analysis of variance (ANOVA) was employed to explore the interaction effects

between the PBL approach and the integration of critical thinking skills. This helps to assess the degree to which these two instructional components influence learners' outcomes. The combination of these analyses provides deeper insights into the effectiveness and interplay of the instructional interventions under investigation. In addition to the quantitative approach, the qualitative data are analyzed through thematic qualitative analysis, which involves three main stages: data condensation (simplifying and organizing data), data display (visual representation), and conclusion drawing and verification, ensuring that the interpretations are grounded and credible.

RESULTS

The results of this study are presented as follows.

Table 1. EFL learners' reading comprehension, linguistic awareness, and critical thinking skills in experimental and control groups

Experimental Group	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Reading Comprehension Pretest	33	15	65	80	74.18	4.341	18.841
Reading Comprehension Posttest	33	20	70	90	81.82	5.388	29.028
Linguistic Awareness Pretest	33	13	65	78	73.27	3.947	15.580
Linguistic Awareness Posttest	33	15	70	85	78.48	2.917	8.508
Critical Thinking Skills	33	10	75	85	79.24	1.733	3.002
Control Group	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Reading Comprehension Pretest	32	15	65	80	74.22	4.294	18.434
Reading Comprehension Posttest	32	16	70	86	79.84	4.393	19.297
Linguistic Awareness Pretest	32	13	65	78	73.22	3.998	15.983
Linguistic Awareness Posttest	32	10	70	80	77.75	2.603	6.774
Critical thinking skills	32	5	75	80	79.06	1.413	1.996

The results in Table 1 of the experimental group indicate clear improvement between the pretest and posttest stages. For reading comprehension, the mean score increased from 74.18 in the pretest to 81.82 in the posttest, reflecting a noticeable gain in performance. The standard deviation also rose slightly from 4.341 to 5.388, suggesting that while students' overall achievement improved, the scores became a bit more dispersed. Similarly, in linguistic awareness, the mean score grew from 73.27 to 78.48, accompanied by a decrease in the standard deviation from 3.947 to 2.917. This indicates that not only did learners achieve higher scores overall, but their

performance also became more consistent across the group. The critical thinking skills of the experimental group were recorded at a mean of 79.24, with a relatively small standard deviation of 1.733, showing both a high level of achievement and homogeneity among participants.

In the control group, improvements were also observed, but they were comparatively modest. Reading comprehension rose from a pretest mean of 74.22 to a posttest mean of 79.84, with standard deviations remaining relatively stable, which reflects moderate progress. Linguistic awareness improved from 73.22 in the pretest to 77.75 in the posttest, with a notable reduction in standard deviation from 3.998 to 2.603, indicating greater consistency in student performance. Critical thinking skills in the control group were slightly lower than in the experimental group, with a mean score of 79.06 and an even smaller standard deviation of 1.413, suggesting very limited variability among students but also showing that improvement in this area was less pronounced compared to the experimental group. Overall, the experimental group demonstrated greater gains in both reading comprehension and linguistic awareness, suggesting that the treatment applied was effective in enhancing learners' performance and consistency across these domains.

The spread of reading achievement in the experimental and control groups or classes can be presented in Figure 1 and Figure 2 of linguistic awareness.

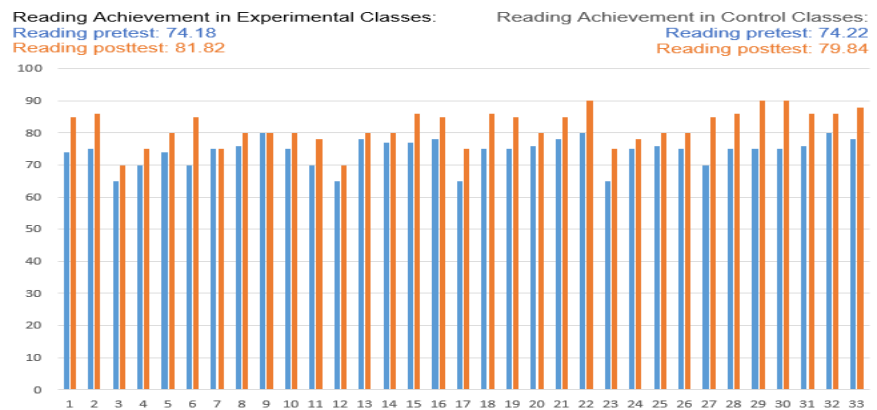


Figure 1. EFL learners' reading achievement

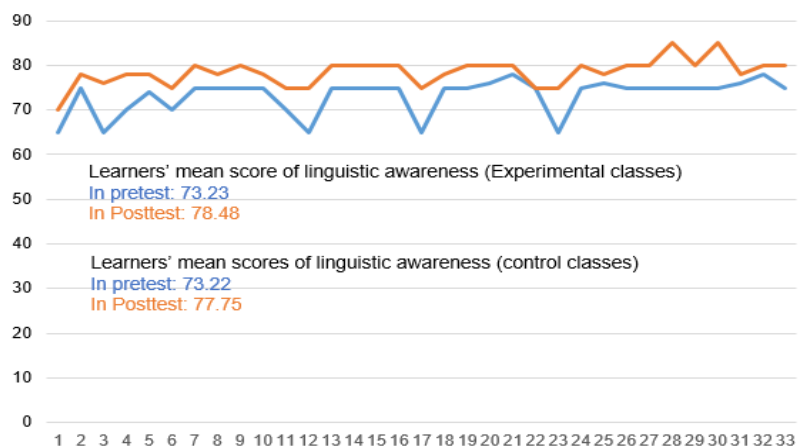


Figure 2. EFL learners' mean scores of linguistic awareness

After gaining the data of reading comprehension and linguistic awareness,

researchers analysed the data of t-test analysis to find out the significant difference of the implementation of problem-based learning materials integrated with critical thinking skills toward EFL learners' reading comprehensions and linguistic awareness. The results of that can be seen in Table 2.

Table 2. Result of t-test analysis of PBL and reading skills

		Independent Samples Test						
Sample t-test analysis	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
						Lower	Upper	
PBL and reading skills	Equal variances assumed	1,616	63	0,010	1974	1,221	-0,467	4,415
	Equal variances not assumed	1,621	61,216	0,010	1974	1,218	-0,460	4,409

The independent samples t-test results in the table assess whether there is a statistically significant difference in reading skills between two groups, presumably the experimental group exposed to PBL and a control group.

The test was conducted under two conditions: equal variances assumed and equal variances not assumed. Both versions of the test yielded nearly identical results, indicating robustness of the findings regardless of the variance equality assumption. Under the assumption of equal variances, the p-value (Sig. 2-tailed) of .010. Since the p-value is less than 0.05, this result is statistically significant. It indicates that there is a meaningful difference in reading skill performance between the two groups. When variances are not assumed to be equal, the p-value is .010, further confirming the significant effect.

These findings support the conclusion that Project-Based Learning (PBL) has a statistically significant positive impact on students' reading skills. Although the confidence interval includes a narrow range around zero, the consistent and significant p-values from both variance assumptions suggest that PBL likely contributes to improved reading outcomes. This reinforces the value of PBL as an effective instructional approach in literacy development.

Table 3. Result of t-test analysis of PBL and linguistics awareness

Sample t-test Analysis		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
PBL and Linguistic Awareness	Equal variances assumed	1,071	63	0,020	0,735	0,686	-0,637	2,107
	Equal variances not assumed	1,072	62,576	0,020	0,735	0,685	-0,635	2,104

not
assumed

The results of the t-test analysis between problem-based learning (PBL) and linguistic awareness show that there is a statistically significant difference at the 0.05 level, as indicated by the Sig. (2-tailed) value of 0.020. This means that the implementation of PBL has a meaningful impact on learners' linguistic awareness, suggesting that students exposed to PBL perform differently compared to those who were not. The mean difference of 0.735, though relatively small, points to a positive trend where PBL appears to contribute to enhanced linguistic awareness.

To explore the interaction effects between the PBL approach and the integration of critical thinking skills, researchers applied analysis variance (ANOVA). This helps to assess the degree to which these two instructional components influence learners' outcomes. The combination of these analyses provides deeper insights into the effectiveness and interplay of the instructional interventions under investigation. The results can be presented in Table 4.

Table 4. Result of ANOVA analysis of PBL and critical thinking skills

Reading and Critical Thinking	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	395,898	1	395,898	23,025	0,000
Within Groups	533,011	31	17,194		
Total	928,909	32			

The ANOVA analysis of reading and critical thinking shows a statistically significant difference between groups. This yields an F-value of 23.025 with a significance level of 0.000, which is well below the 0.05 threshold. This indicates that the variation in critical thinking associated with reading performance is not due to chance but reflects a genuine difference between the groups. This large gap highlights that the differences in reading are strongly linked to differences in critical thinking abilities. The significant result suggests that reading activities or competencies play a meaningful role in fostering critical thinking skills, reinforcing the idea that strengthening reading comprehension can directly enhance learners' higher-order cognitive abilities.

DISCUSSION

The findings of this study provide compelling evidence that problem-based learning (PBL) integrated with critical thinking skills significantly improves EFL learners' reading comprehension and linguistic awareness. Compared to the control group, students in the experimental group achieved greater gains in both areas, indicating that PBL is not only effective for enhancing language skills but also for fostering deeper levels of cognitive engagement. These results align with prior research emphasizing the value of learner-centered and problem-oriented approaches in language instruction. They also contribute to ongoing scholarly discussions on the intersection of reading comprehension, linguistic awareness, and critical thinking in EFL education.

The significant improvement in reading comprehension among the experimental

group is consistent with the findings of [Haerazi and Irawan \(2020\)](#) and [Fitriyah et al. \(2024\)](#), who argued that PBL enables learners to engage with texts more purposefully by situating reading within the context of problem-solving. By embedding reading tasks in authentic problem contexts, learners were not simply decoding or summarizing textual information but actively constructing meaning, making inferences, and evaluating content. This deeper engagement likely accounts for the greater improvements observed in the experimental group compared to the control group. In this sense, the study extends previous research by confirming that PBL not only enhances surface-level comprehension but also supports higher-order reading processes such as analysis and synthesis.

The results also support the claim of [Toprak and Cakir \(2021\)](#) that reading comprehension should be seen as a multidimensional process involving vocabulary, syntax, discourse structure, and background knowledge. The experimental group's significant gains illustrate that PBL offers a pedagogical framework capable of integrating these dimensions. Learners were required to negotiate meaning in collaborative settings, connect textual information to real-world contexts, and apply critical thinking to evaluate solutions. Such integrated learning experiences may explain why the experimental group's reading comprehension improved more substantially than that of the control group, whose instruction was limited to more traditional, teacher-centered practices.

Another important finding of the study is the observed improvement in linguistic awareness, with the experimental group showing greater gains than the control group. Linguistic awareness, as defined by [Vaahtoranta et al. \(2021\)](#), includes phonological, morphological, syntactic, semantic, and pragmatic components. The posttest results suggest that PBL created opportunities for learners to consciously reflect on and manipulate these structural components in ways that traditional instruction did not. This finding corroborates [Firman et al. \(2021\)](#), who argued that explicit and contextualized practice of linguistic features within meaningful tasks enhances learners' awareness and metalinguistic reflection. PBL, by requiring learners to use language as a tool for problem-solving, naturally integrates form and meaning, thereby fostering awareness of language structure and use.

The t-test analysis further supports the effectiveness of PBL in improving both reading comprehension and linguistic awareness. The statistically significant differences between the experimental and control groups demonstrate that the observed improvements are not incidental but attributable to the intervention. The relatively small yet meaningful mean difference in linguistic awareness suggests that while PBL's impact is notable, its effect size may be more modest compared to reading comprehension. This discrepancy could be explained by the fact that linguistic awareness is often developed gradually and may require sustained exposure and practice over longer periods. Nevertheless, the results contribute to the body of literature affirming that pedagogical strategies emphasizing active learning, problem-solving, and reflection can positively impact metalinguistic development ([Suratullah et al., 2023](#); [Naqsyabandiyah & Dehghanitafti, 2023](#)).

The analysis results highlight a strong and statistically significant relationship between reading comprehension and critical thinking skills. This finding supports [Azzalini \(2023\)](#), who posited that higher-order thinking skills are inseparable from advanced reading proficiency. In line with [Mohammadi et al. \(2020\)](#), the data suggest that

reading is not a passive activity but an intellectual exercise requiring the ability to analyze arguments, evaluate evidence, and synthesize ideas. By integrating critical thinking tasks into PBL materials, this study demonstrates that reading instruction can simultaneously strengthen learners' reasoning and evaluative skills.

Interestingly, the results also highlight areas of potential divergence from expectations. While significant gains were observed in reading comprehension and linguistic awareness, the improvement in critical thinking skills, though evident, was relatively modest in numerical terms. This may suggest that while PBL naturally embeds elements of critical thinking, the explicit teaching of critical thinking strategies might be necessary to achieve more substantial gains. Previous research by [Ikawati and Pohan \(2023\)](#) emphasizes that critical thinking does not automatically emerge from collaborative or problem-based learning environments; instead, it requires intentional scaffolding, guided questioning, and reflective practices. Thus, the modest improvement observed in this study could be attributed to the absence of explicit, systematic instruction in critical thinking, even though the PBL framework provided a conducive context.

Theoretically, these findings contribute to the growing body of evidence supporting constructivist approaches to language learning. PBL reflects the constructivist principle that knowledge is best acquired when learners actively construct meaning through authentic, real-world tasks. The study's results confirm the theoretical claim advanced by [Girma et al. \(2025\)](#) that social interaction and collaborative meaning-making are essential for both linguistic and cognitive development. By demonstrating measurable improvements in reading comprehension and linguistic awareness, this study reinforces the notion that EFL learners benefit from instructional approaches that integrate language, cognition, and context.

Practically, the findings have several implications for EFL teaching and curriculum design. First, they suggest that integrating PBL into reading instruction can significantly enhance learners' comprehension skills and linguistic awareness, making it a valuable strategy for teachers seeking to promote deeper learning. Second, the results underscore the importance of designing PBL materials that explicitly incorporate critical thinking tasks. Teachers should develop activities that require learners not only to solve problems but also to justify their reasoning, evaluate multiple perspectives, and reflect on their decision-making processes. Third, the study highlights the potential of PBL to reduce disparities in learners' performance, as evidenced by the decreased variability in posttest scores for linguistic awareness in the experimental group. This suggests that PBL fosters a more equitable learning environment by engaging all learners in meaningful, collaborative tasks.

The study also contributes to policy-level discussions on EFL instruction in Indonesia and similar contexts. As [Haerazi et al. \(2019, 2023\)](#) argued, national education systems must adopt innovative approaches that move beyond rote learning and memorization. The demonstrated effectiveness of PBL provides empirical support for policy initiatives that prioritize student-centered and inquiry-based pedagogies. Furthermore, the integration of critical thinking into language instruction aligns with broader educational goals of preparing learners for the demands of the 21st century, where problem-solving, creativity, and adaptability are highly valued.

Despite these contributions, certain limitations warrant consideration. The relatively small sample size may limit the generalizability of the findings. Additionally, the

modest gains in critical thinking suggest that further research is needed to explore how PBL can be optimized to explicitly teach and assess critical thinking skills. Future studies could employ longitudinal designs to investigate the long-term effects of PBL on linguistic awareness, as well as experimental designs that isolate the impact of explicit critical thinking instruction within a PBL framework.

This study demonstrates that problem-based learning integrated with critical thinking skills significantly enhances EFL learners' reading comprehension and linguistic awareness. The findings confirm and extend previous research while also raising important questions about how to maximize the impact of PBL on critical thinking. Theoretically, the study reinforces constructivist perspectives on language learning, while practically, it provides teachers and policymakers with evidence-based strategies for improving language education. By situating reading instruction within authentic, problem-solving contexts and fostering reflective, critical engagement with texts, PBL holds considerable promise for advancing both linguistic and cognitive development among EFL learners.

CONCLUSION

The findings of this study demonstrate that problem-based learning (PBL) integrated with critical thinking skills significantly enhances EFL learners' reading comprehension and linguistic awareness. Compared to the control group, the experimental group achieved greater improvements in both areas, confirming that PBL provides meaningful contexts for learners to actively engage with texts, negotiate meaning, and apply language structures in authentic problem-solving situations. The integration of critical thinking further strengthened learners' ability to analyze, evaluate, and synthesize information, which are essential skills for higher-order comprehension. These outcomes reinforce constructivist perspectives on language learning, highlighting that meaningful and learner-centered approaches can effectively bridge the gap between linguistic development and cognitive growth.

In practical terms, the study contributes valuable insights for EFL teachers, curriculum designers, and policymakers by demonstrating the pedagogical potential of PBL in fostering deeper engagement with reading and language use. The approach not only improved learners' performance but also encouraged collaboration and reflection, creating a more equitable and supportive learning environment. While the gains in critical thinking were modest compared to reading comprehension and linguistic awareness, the results suggest that explicit scaffolding of critical thinking strategies within PBL can further strengthen its impact. Overall, this study confirms that integrating PBL with critical thinking is a promising instructional model that prepares learners to become competent, independent, and reflective users of English in both academic and real-world contexts.

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CONFLICT OF INTERESTS

The authors declare that they have no conflict of interest.

AUTHOR(S) CONTRIBUTION

Pujayanti, K.A.: was responsible for conceptualization (lead), methodology (lead), writing – original draft (lead), review (supporting), and securing funding. **Haerazi.:** contributed to conceptualization (supporting), methodology (supporting), writing–original draft (supporting), review (lead), and editing (lead). **Rahman, A.:** was involved in conceptualization (supporting), methodology (supporting), writing – original draft (supporting), review (lead), and editing (lead). Together, the three authors collaborated closely throughout the research process, ensuring the rigor, clarity, and quality of the study.

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