

Effectiveness of Problem Based Learning Models on Student Argumentation Text Analysis Abilities

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Abstract

- Purpose** : This study examines the effectiveness of Problem-Based Learning (PBL) in improving students' argumentative-text analysis skills. It addresses the limited empirical evidence on the use of PBL for analytical reading of argumentative texts and evaluates its contribution to higher-order analytical skills.
- Method** : A quantitative quasi-experimental pre-test-post-test control group design was employed with 132 students selected through purposive sampling, consisting of 67 students in the experimental group and 65 in the control group. Data were collected using a validated argumentative-text analysis test. Paired-samples *t*-tests were used to examine within-group improvement, while independent-samples *t*-tests assessed differences between groups. N-Gain measured learning improvement, and Cohen's *d* determined the effect size.
- Results** : The groups showed comparable initial abilities. Both groups improved significantly after instruction, but the experimental group achieved substantially higher post-test performance. The experimental group obtained a moderate N-Gain (0.52), while the control group showed a low N-Gain (0.26). The intervention produced a very large effect size (Cohen's *d* = 2.94), indicating a substantial effect of PBL on argumentative-text analysis skills.
- Conclusion** : PBL is effective in improving students' ability to analyse argumentative texts. The study extends PBL application from general language learning to argumentative-text analysis and highlights its potential to strengthen analytical reading, evidence evaluation, discussion, inquiry, and higher-order reasoning in language education.

Keywords: *Problem-Based Learning*; ability to analyse argumentation text

1. Introduction

The ability to analyse argumentative texts is an important part of academic literacy in higher education. University students are expected not only to understand what a text says but also to examine how an argument is constructed, whether the evidence supports the claims, how ideas are connected, and whether the conclusions are logically justified. These abilities are closely related to critical thinking. When students engage with an argumentative text, they need to evaluate the

validity of claims, consider the relevance of evidence, and determine whether the reasoning presented by the writer is convincing (Akib et al., 2024; Muhsin et al., 2024). Understanding argumentative structures is also important because elements such as claims, evidence, counterclaims, and rebuttals provide a basis for evaluating the quality of an argument and the development of students' argumentative competence (Stahl et al., 2024). In this sense, learning to analyse argumentative texts is not simply a matter of improving language skills. It also provides students with opportunities to develop the analytical and critical-thinking abilities needed for academic study and everyday decision-making.

The relationship between argumentation and higher-order thinking becomes particularly clear when students are asked to examine how an argument works. To understand an argument, students need to distinguish claims from supporting reasons, determine whether evidence is relevant and sufficient, consider alternative viewpoints, and recognize possible counterarguments or weaknesses in reasoning. These activities require more than remembering information; they involve analysis, evaluation, and synthesis. Research has shown that critical thinking in argumentative writing is reflected in students' ability to analyse argument components, draw inferences, and evaluate the accuracy and logical validity of arguments (Kusumo et al., 2025; Muhsin et al., 2024). In higher education, argumentative writing also provides an important setting for developing these abilities because students are required to take positions, justify their views, and respond to competing perspectives (Bharuthram, 2026; Kleemola et al., 2022). Thus, argumentation should be understood as both a language activity and a cognitive process through which students learn to examine ideas and make reasoned judgments.

Empirical studies provide further evidence of this relationship. Muhsin et al. (2024) found that critical thinking was reflected in the way higher education students constructed and organized arguments in their essays. Their findings suggest that argumentative writing can serve as a context for developing analytical reasoning. Sandra et al. (2024) similarly reported that argumentative writing is an important component of undergraduate academic writing, while noting that students often struggle to develop logically structured arguments and interpret evidence appropriately. Akib et al. (2024) also found that students needed to improve their ability to construct logical arguments, evaluate evidence critically, and express ideas coherently. Other studies have reported positive effects of approaches that explicitly integrate critical thinking into argumentative writing. Wang and Newell (2025) found that such approaches encouraged students to take reasoned positions and support their claims with relevant evidence. Chen et al. (2025) further demonstrated that collaborative inquiry-based instruction could improve both critical thinking and students' ability to construct arguments. Experimental research has also indicated that instruction involving counter argumentation can strengthen argumentative writing and critical thinking, particularly when students are encouraged to develop substantive and well-supported counterarguments. Taken together, these findings suggest that effective argumentation involves much more than producing grammatically correct text. Students need to understand relationships among ideas, assess evidence, recognize alternative positions, and determine whether conclusions follow logically from the arguments presented.

Despite these findings, students in Indonesia continue to experience difficulties with the higher-order processes involved in argumentation. Muhsin et al. (2024) in their study of

argumentative essays written by higher education students in Makassar, found that students' critical thinking in argumentation was still uneven, particularly in constructing and evaluating reasoning. Akib et al. (2024) likewise reported difficulties among Indonesian university students in constructing logical arguments, evaluating evidence, and articulating ideas coherently. These difficulties suggest that the problem is not simply a matter of students lacking the ability to express their ideas in writing. Rather, students may also have difficulty determining how claims, reasons, and evidence work together to form a convincing argument. Consequently, students need learning experiences that give them opportunities to examine arguments systematically, question the evidence presented, identify weaknesses in reasoning, and arrive at conclusions based on careful analysis.

This issue is particularly relevant for students who are not majoring in language or language education. At Universitas PGRI Sumatera Barat (UPGRISBA), students from non-language programs are required to take Indonesian language courses as part of their university-level general education. Although these students encounter academic texts regularly, they generally do not receive the same level of systematic instruction in linguistic and rhetorical analysis as students majoring in Indonesian language or language education. Nevertheless, they are expected to understand academic texts and to demonstrate the ability to identify claims, evaluate evidence, examine reasoning, and draw logical conclusions.

Preliminary observations of learning activities and students' work in Indonesian language courses at UPGRISBA suggest that these expectations are not always easy for non-language students to meet. Students tend to be more successful in locating explicit information in a text than in examining the relationships among claims, reasons, and evidence. Difficulties are also apparent when students are asked to distinguish argumentative components, evaluate the relevance or strength of evidence, identify weaknesses in an argument, or infer meanings that are not stated explicitly. These observations are consistent with previous research showing that university students often encounter difficulties when constructing and evaluating arguments and when applying critical reasoning to argumentative tasks (Akib et al., 2024; Muhsin et al., 2024; Sandra et al., 2024). The situation suggests that students need a learning environment in which they can actively investigate and discuss arguments rather than simply receive explanations about argumentative structures.

One instructional approach that may respond to these needs is Problem-Based Learning (PBL). PBL places meaningful problems at the centre of learning and encourages students to investigate issues, search for relevant information, discuss possible explanations, evaluate evidence, and develop reasoned solutions. Such activities are closely related to the cognitive processes involved in analysing argumentative texts. Rather than receiving a predetermined interpretation from the lecturer, students are encouraged to investigate a problem, consider different perspectives, and justify the conclusions they reach. This emphasis on active inquiry and reasoning makes PBL particularly relevant to learning situations in which students need to develop higher-order thinking.

Previous research has reported promising results regarding the use of PBL to develop students' cognitive and language-related abilities. Yu & Zin (2023) through a systematic review of PBL in higher education, found that adaptations of PBL that explicitly incorporate critical-thinking activities can enhance students' critical-thinking skills. This suggests that the effectiveness of PBL

depends not only on presenting students with problems but also on how learning activities are structured to encourage analysis, evaluation, and reasoning. Therefore, PBL is particularly relevant to learning situations in which students are expected to examine evidence, evaluate arguments, and develop higher-order thinking skills.

Helaluddin et al. (2023) found that PBL contributed to students' writing performance as well as their critical and creative thinking skills. Setyawati et al. (2024) reported that an argumentation-based PBL model improved students' critical-thinking skills, suggesting that combining problem solving with argumentation can provide students with meaningful opportunities to evaluate and justify ideas. In language education, Khotimah & Iswanto (2024) found that PBL improved students' critical-thinking skills and argumentative essay writing. Other recent studies have also reported positive effects of PBL on language learning, student engagement, academic performance, and higher-order cognitive development in higher education contexts (Assefa et al., 2026; Guo et al., 2024; Long et al., 2024). These findings provide a reasonable basis for considering PBL as a potential approach for teaching students to engage more deeply with argumentative texts.

The relevance of PBL becomes even clearer when its learning process is compared with the demands of argumentative-text analysis. When analysing an argumentative text, students need to identify the central issue, examine the claims and evidence, determine the strength of the reasoning, consider alternative interpretations, and formulate a conclusion based on the available evidence. These activities can be incorporated into problem-based learning through investigation, group discussion, evidence gathering, evaluation, and reflection. Students can therefore approach an argumentative text as a problem that needs to be investigated rather than as a text whose meaning has already been determined by the lecturer. This is an important distinction from conventional lecturer-centered instruction, which may explain the structure of an argument effectively but may provide fewer opportunities for students to independently question evidence, compare interpretations, and justify their analytical decisions. In this respect, the value of PBL lies not simply in its status as an innovative teaching model but in the fit between its learning processes and the cognitive demands of argumentative-text analysis.

Despite growing evidence that PBL can enhance critical thinking, writing performance, problem-solving, and language learning, most previous studies have focused on broad learning outcomes or students' ability to produce argumentative texts rather than their ability to analyse existing argumentative texts. Although Khotimah & Iswanto (2024) demonstrated the effectiveness of PBL in improving critical thinking and argumentative writing, limited attention has been given to whether PBL can specifically support students in deconstructing and evaluating arguments that have already been constructed by other writers. In particular, the processes of identifying argumentative structures, examining logical relationships, evaluating the relevance and strength of evidence, recognizing weaknesses in reasoning, and drawing evidence-based conclusions remain comparatively underexplored. This gap is especially relevant to non-language university students, who regularly encounter argumentative discourse in academic contexts but generally receive less systematic instruction in rhetorical and argumentative analysis. Therefore, further research is needed to examine whether PBL can effectively develop argumentative-text analysis skills among non-language students in higher education.

The present study addresses this gap by examining the effectiveness of Problem-Based Learning in developing argumentative-text analysis skills among non-language students at Universitas PGRI Sumatera Barat (UPGRISBA). The focus is deliberately placed on the analysis of existing argumentative texts rather than on argumentative-text production alone. In this study, argumentative-text analysis involves students' ability to identify argumentative structures, examine relationships among claims, reasons, and evidence, evaluate the relevance and strength of supporting evidence, recognize weaknesses in reasoning, interpret implicit meanings, and draw logical conclusions. By focusing on these abilities, the study seeks to move beyond the broader question of whether PBL improves critical thinking and instead examine how PBL may support a specific form of academic literacy: the ability to critically read, deconstruct, and evaluate arguments.

The novelty of this study therefore lies in the intersection of three elements that have received relatively limited attention in previous research: PBL as the instructional approach, argumentative-text analysis as the primary learning outcome, and non-language students in Indonesian higher education as the target population. This combination provides a different perspective from studies that primarily examine argumentative writing or critical thinking as general outcomes. The study also contributes contextual evidence from UPGRISBA, where Indonesian language courses serve students from diverse non-language disciplines. Theoretically, the findings may strengthen the understanding of how problem-oriented learning can support argumentative-text analysis as a higher-order cognitive activity. Practically, the findings may provide lecturers with an alternative way to engage non-language students in examining textual problems, evaluating evidence, analysing reasoning, and developing evidence-based conclusions.

Based on this rationale, the present study aims to examine the effectiveness of Problem-Based Learning in improving the argumentative-text analysis skills of non-language students in higher education. More specifically, it investigates whether students who learn through PBL demonstrate greater improvement than those receiving conventional instruction in identifying argumentative structures, analysing logical relationships, evaluating the strength and relevance of evidence, recognizing weaknesses in reasoning, interpreting implicit meanings, and drawing systematic conclusions from argumentative texts.

2. Method

This study employed a quantitative approach using a quasi-experimental pre-test-post-test control group design. The design was chosen because the research was conducted in existing classes, making it impractical to randomly assign individual students to different groups. A quasi-experimental design was therefore appropriate for examining the effectiveness of the instructional intervention by comparing changes in an experimental group with those observed in a control group (Anantasia et al., 2025).

Two intact classes participated in the study. One class served as the experimental group and received instruction through the Problem-Based Learning (PBL) model, while the other served as the control group and received conventional instruction. Both groups completed the same test before and after the intervention. The pre-test was administered to determine the students' initial abilities, whereas the post-test was used to examine changes in their argumentative-text analysis skills following the instructional treatment. The research design is presented in Table 1.

Table 1. Research Design

Group	Pre-test	Treatment	Post-test
Experiment	O ₁	X (PBL)	O ₂
Control	O ₃	-	O ₄

Note: O₁ = experimental-group pre-test; O₂ = experimental-group post-test; O₃ = control-group pre-test; O₄ = control-group post-test; X = Problem-Based Learning (PBL) treatment; - = conventional instruction.

The study involved non-language students at Universitas PGRI Sumatera Barat (UPGRISBA) who were enrolled in Indonesian language courses during the even semester of the 2025/2026 academic year. The study focused on non-language students because Indonesian language courses are part of their general university education, even though their main fields of study are outside language and language education.

The sample was selected using purposive sampling. The selection considered the similarity of students' academic characteristics and their relatively comparable initial abilities. Two existing classes were selected, consisting of 65 students in the experimental group and 67 students in the control group. The experimental group received PBL instruction, whereas the control group followed the conventional instructional approach used in the course.

Data were collected using an objective test administered as both a pre-test and a post-test. The test was developed to measure students' ability to analyze argumentative texts and consisted of 50 objective items. The development of the instrument was based on the cognitive demands involved in argumentative-text analysis. As Brookhart (2023) explains, effective assessment should translate the competencies targeted in learning into observable and measurable indicators. In argumentation, these competencies include not only recognizing the elements of an argument but also examining relationships among claims, reasons, and evidence and evaluating the adequacy of the reasoning supporting a conclusion (Rapanta & Macagno, 2023).

Accordingly, the test covered five indicators developed through a synthesis of recent research on argumentative-text analysis, argument evaluation, and critical reasoning (Akib et al., 2024; Du & Gao, 2024; Muhsin et al., 2024; Münchow et al., 2023; Wang & Newell, 2025; Yang et al., 2025). The indicators comprised (1) identification of argumentative structures, including claims, reasons, evidence, and conclusions; (2) analysis of logical relationships, focusing on how claims, reasons, evidence, and conclusions are connected; (3) evaluation of argument strength, including the relevance, adequacy, and credibility of supporting evidence; (4) identification of argument weaknesses, including unsupported claims, inconsistencies, and weaknesses in reasoning; and (5) drawing evidence-based conclusions, referring to the ability to formulate logical conclusions based on the information and evidence presented in the text.

These indicators were selected because argumentative-text analysis requires students to go beyond recalling information. Students must examine relationships among ideas, evaluate evidence, identify weaknesses in reasoning, and formulate conclusions based on textual information. The same instrument was used for both the pre-test and post-test to ensure consistency in measuring changes in students' abilities.

The content validity of the test was established through expert judgment. Two experts in Indonesian language education and language assessment independently reviewed all 50 items. The experts evaluated each item in terms of its relevance to the intended competency, clarity of wording, appropriateness of content, and alignment with the targeted argumentative-text analysis skills. Based on their feedback, the items were considered to adequately represent the intended content domain. Several items were revised, particularly in terms of wording clarity and the alignment between the questions and the specified indicators.

The revised instrument was then pilot-tested with 30 students who were not included in the main study. The try-out was conducted to determine the reliability and internal consistency of the test. Because the items were scored dichotomously as correct or incorrect, reliability was examined using the Kuder–Richardson 20 (KR-20) coefficient. The analysis resulted in a reliability coefficient of 0.89, indicating high internal consistency. The 50-item test was therefore considered reliable and suitable for use in the main study.

The PBL intervention in the experimental group consisted of five stages: problem orientation, group organization, investigation, presentation, and reflection and evaluation. In the first stage, students were presented with an authentic argumentative-text problem and asked to identify the main issue and formulate questions. This problem-oriented approach is consistent with the principle of PBL, which encourages active investigation of meaningful problems (Liu & Pásztor, 2022). In the second stage, students worked in small groups to identify claims, reasons, evidence, and conclusions and discuss the relationships among these elements. This collaborative process is consistent with evidence that PBL can support learning and critical-thinking development in higher education language contexts (Orhan, 2024). In the third stage, students investigated the text by analyzing logical relationships, evaluating the relevance and strength of evidence, and identifying weaknesses in reasoning, while the lecturer provided guidance and feedback (Liu & Pásztor, 2022; Mutiara et al., 2024). In the fourth stage, groups presented their analytical findings and responded to questions and alternative interpretations from other groups, providing opportunities to justify ideas and evaluate evidence (Abdollahzadeh et al., 2024; Setyawati et al., 2024). Finally, students reflected on their analytical process and evaluated whether their conclusions were adequately supported by textual evidence, consistent with the reflective and higher-order learning processes associated with PBL (Assefa et al., 2026). Overall, these five stages provided students with opportunities to investigate problems, collaborate, evaluate evidence, justify reasoning, and formulate conclusions, directly corresponding to the five competencies assessed in argumentative-text analysis.

The data were analyzed in several stages. First, normality and homogeneity tests were conducted as prerequisite analyses. Normality was examined using the Kolmogorov–Smirnov test, while the homogeneity of variance was assessed using Levene’s test. The differences between the experimental and control groups were then examined using the independent-samples *t*-test. This test was applied to the pre-test scores to determine whether the two groups had comparable initial abilities and to the post-test scores to determine whether their abilities differed after the intervention. Within-group changes from pre-test to post-test were examined using the paired-samples *t*-test.

The magnitude of students' improvement was also examined using N-Gain scores. The resulting values were interpreted using the conventional low, moderate, and high categories. Statistical significance was determined at $\alpha = 0.05$, with a p -value or Sig. (2-tailed) below 0.05 interpreted as indicating a statistically significant difference.

The study followed the ethical principles applicable to educational research. Before data collection, permission to conduct the study was obtained from Universitas PGRI Sumatera Barat (UPGRISBA) and the relevant academic unit. Students were informed about the purpose and procedures of the study and the activities they would undertake during the research. Participation was voluntary, and students were informed that their participation would not affect their academic grades or academic standing. The confidentiality of participants' identities and research data was also maintained. Student names were replaced with codes during data processing and analysis, and the collected data were used solely for research purposes. The pre-test, instructional intervention, and post-test were conducted in accordance with the applicable institutional and research-ethics requirements.

3. Result

In this section, the results of the analysis of data on the ability to analyse student argumentation texts in control classes obtained through pre-test and post-test measurements are presented. Pre-tests are carried out to determine students' initial abilities before being given treatment, while post-tests are carried out to see their abilities after the learning process. Results comparison *pre-test* and *post-test* it was used to determine the extent of improvement in the ability to analyse student argumentation texts on each of the indicators that have been established in this study. Below is a table of value comparisons *pre-test* and *post-test* text analysis ability of student arguments in control class.

Table 2. Value Comparison *Pre-test* and *Post-test* Student Argumentation Text Analysis Ability (Control Class)

No	Indicator	<i>Pre-test</i>	<i>Post-test</i>
1	Identify the structure of the argument	70	78
2	Logical relationship analysis	68	76
3	Evaluate the strength of the argument	71	79
4	Identify argument weaknesses	69	77
5	Drawing conclusions	70	76
Overall average		69,57	77,31

Based on the analysis of students' scores for each indicator, the mean pre-test score was 69.57, which increased to 77.31 in the post-test. This improvement indicates that students' argumentative-text analysis skills developed after the learning intervention. As shown in the indicator-level results, all five indicators demonstrated improvement from pre-test to post-test. For argumentative-structure identification, students became better able to recognize the main components of an

argument. Improvement was also observed in logical-relationship analysis, indicating that students developed a better understanding of how ideas, claims, reasons, and evidence are connected within an argument.

A similar pattern was found for argument-strength evaluation, where students showed greater ability to assess the validity, relevance, and adequacy of arguments. Their ability to identify weaknesses in arguments also improved, suggesting that students became more attentive to unsupported claims, inconsistencies, and weaknesses in reasoning. Meanwhile, the conclusion indicator showed that students became better able to formulate logical conclusions based on the information and evidence presented in the text.

Overall, the mean score increased by 7.74 points, indicating a positive development in students' ability to analyze argumentative texts. The improvement across all indicators suggests that students were not only becoming more familiar with argumentative structures but were also developing greater confidence in examining relationships among ideas, evaluating evidence, recognizing weaknesses in reasoning, and drawing conclusions. These changes are particularly relevant to argumentative-text analysis because the task requires students to go beyond identifying explicit information and engage with the underlying logic of an argument.

Despite this improvement, the increase in the control group remained relatively modest. The students' performance moved from the medium category in the pre-test to a slightly higher level in the post-test. This suggests that conventional instruction was able to support some improvement in students' analytical abilities, but the gains were not substantial. A more detailed picture of the changes in students' performance can be seen from the distribution of scores for each indicator, as presented in the following table.

Table 3. Distribution of Values of Student Argumentation Text Analysis Ability

Value Interval	Category	Frequency (Pre-test)	Percentage (%)	Frequency (Post-test)	Percentage (%)
75-100	High	8	12,3	44	67,7
61-74	Medium	52	80	21	32,3
≤60	Low	5	7,7	0	0
Total		65	100	65	100

According to the table of distribution, a significant shift from *pre-test* to *post-test*. On *pre-test*, the majority of students are in the medium category at 80%, while in *post-test* the majority of students were in the high category of 67.7%. In addition, the previously still emerging low category of 7.7% in *pre-test*, no longer found on *post-test*.

Overall, these results show that there is an improvement in the analysis ability of the student argumentation text in the control class, although the increase is still moderate and has not shown very sharp changes. Therefore, more effective learning strategies are needed to optimize students' argumentation text analysis skills.

The findings in the control class provide an illustration that conventional learning has not been fully able to promote optimal improvement of the analytical capabilities of argumentation texts. This condition shows the need to implement a more innovative learning approach and is

oriented towards developing higher-level thinking skills. In line with this, in the experimental class in this study, the Problem-Based Learning model was applied to test its effectiveness in improving students' argumentation text analysis skills.

In this section, the results of the analysis of data on the analytical ability of student argumentation texts in experimental classes are presented, obtained through measurements *pre-test* and *post-test*. *Pre-test* carried out to determine students' initial abilities before being given treatment, meanwhile *post-test* carried out to see capabilities after model implementation *Problem-Based Learning*. Below is a table of value comparisons *pre-test* and *post-test* Text Analysis Ability of Student Arguments in experimental classes.

Table 4. Value Comparison *Pre-test* and *Post-test* Student Argumentation Text Analysis Ability (Experiment Class)

No	Indicator	<i>Pre-test</i>	<i>Post-test</i>
1	Identify the structure of the argument	71	83
2	Logical relationship analysis	70	85
3	Evaluate the strength of the argument	72	87
4	Identify argument weaknesses	69	82
5	Drawing conclusions	71	87
Overall average		70,73	84,79

Based on the table, students in the experimental group showed clear improvement in their argumentative-text analysis skills after the PBL intervention. The overall mean score increased from 70.73 in the pre-test to 84.79 in the post-test, representing a gain of 14.06 points. Improvement was observed across all five indicators, although the magnitude of change varied from one indicator to another.

The greatest improvement was found in the evaluation of argument strength. This result may be related to the characteristics of PBL, which require students to investigate problems, examine evidence, discuss different interpretations, and justify their analytical decisions. Through these activities, students had repeated opportunities to consider whether evidence was relevant and sufficient and whether an argument was logically convincing. Thus, the PBL activities provided direct practice for the cognitive processes involved in evaluating the quality of an argument.

In contrast, identifying weaknesses in arguments showed a relatively smaller improvement. This indicator requires a more sophisticated level of analysis because students must move beyond understanding what an argument says to recognizing unsupported claims, inconsistencies, or weaknesses that may not be explicitly stated. Although PBL provided opportunities to develop this ability through investigation and discussion, identifying implicit weaknesses may require more sustained practice and reflection.

The indicators of argumentative-structure identification and logical-relationship analysis also improved from pre-test to post-test. The gains suggest that students became more capable of

recognizing the basic components of an argument and understanding how claims, reasons, evidence, and conclusions are connected. However, the relatively moderate improvement in these areas indicates that students may still need further practice in applying these skills to more complex argumentative texts.

Overall, the different patterns of improvement across indicators suggest that PBL was particularly useful for developing students' evaluative and analytical abilities, especially when they were required to examine the strength of evidence and justify their conclusions. This finding is consistent with the central characteristics of PBL, in which students learn through investigation, discussion, problem solving, and reflection rather than simply receiving explanations from the lecturer. The results therefore suggest that the effectiveness of PBL is not limited to increasing students' overall scores but also lies in providing opportunities for students to engage with different levels of argumentative-text analysis. A more detailed picture of the changes in students' performance can be seen from the distribution of scores in the experimental group, as presented in the following table.

Table 5. Distribution of Values of Student Argumentation Text Analysis Ability (Experiment Class)

Value Interval	Category	Frequency (<i>Pre-test</i>)	Percentage (%)	Frequency (<i>Post-test</i>)	Percentage (%)
75-100	High	10	14,9	55	82,1
61-74	Medium	50	74,6	12	17,9
≤60	Low	7	10,5	0	0
Total		67	100	67	100

Based on the results of data analysis, it can be seen that there was an increase in the ability to analyze student argumentation texts in the experimental class after application *Problem Based Learning Model*. This is shown by the change in the distribution of value categories, where at the pre-test the majority of students are in categories **medium** amounting to 74.6%, while the category **high** only 14.9% and categories **low** by 10.5%. After treatment, there was a very significant increase in the categories **high** to 82.1%, while category medium decreased to 17.9% and there were no more students in the category **low**. Overall, these results indicate that there is an improvement in the ability to analyze student argumentation texts in the experimental class which is higher than in the control class. This indicates that the application of *Problem Based Learning* more effective in improving students' argumentation text analysis skills.

Before a hypothesis test using the mean difference test, the analysis requirements test is first carried out. This test aims to ensure that the research data meets the necessary statistical assumptions, such as normality tests and homogeneity tests, so that the test results obtained can be declared valid and reliable. The prerequisite tests of the analysis in this study were carried out using the help of the SPSS program to ensure that the data met the parametric statistical assumptions. Normality tests were carried out using Shapiro-Wilk because the number of samples in each group was less than 200. Below is a table of data normality test results.

Table 6. Data Normality Test Results

No	Data	Sig. (p-value)	Description
1	Pre-test Control Class	0.061	Normal
2	Post-test Control Class	0.057	Normal
3	Pre-test Experiment Class	0.062	Normal
4	Experiment Class Post-test	0.085	Normal

The normality test showed that all pre-test and post-test data were normally distributed. The significance values for the control group were 0.061 for the pre-test and 0.057 for the post-test, while those for the experimental group were 0.062 and 0.085, respectively. Because all values were greater than 0.05, the normality assumption was satisfied. This result indicates that the data were appropriate for further analysis using parametric statistical tests.

Homogeneity was then examined using Levene's Test to determine whether the variances of the two groups were comparable. The test produced a significance value of 0.450 for the pre-test and 0.551 for the post-test, with Levene statistics of 0.574 and 0.358, respectively. Since both significance values exceeded 0.05, the variances of the experimental and control groups could be considered homogeneous. Therefore, the data met the assumptions required for subsequent parametric analysis.

After the assumptions of normality and homogeneity were met, an Independent Samples *t*-test was conducted to compare the argumentative-text analysis skills of the experimental and control groups at the pre-test and post-test stages. In addition, a Paired Samples *t*-test was used to examine changes within each group from pre-test to post-test. These analyses provided the basis for determining whether the implementation of Problem-Based Learning (PBL) resulted in greater improvement in students' argumentative-text analysis skills than conventional instruction.

Table 7. Recapitulation of Test Results t Student Argumentation Text Analysis Ability

Analysis	Class	N	Mean	Standard Deviation	t	df	Sig. (2- tailed)	Description
Initial Ability (Pre-test)	Control	65	69,57	3,12	-1.87	130	0.064	Not significant
	Experiment	67	70,73	3.05				
Control (Pre- test-Post-test)	Pre-test	65	69,57	3,12	-12,45	64	0.000	Significant
	Post-test	65	77,31	3,10				
Experiment (Pre-test-Post- test)	Pre-test	67	70,73	3.05	-18.76	66	0.000	Significant
	Post-test	67	84,79	2.85				
Final Comparison (Post-test)	Control	65	77,31	3,10	-13,21	130	0.000	Significant
	Experiment	67	84,79	2.85				

Based on the results of the recapitulation of statistical tests using the Independent Sample *t*-test and the Paired Sample *t*-test, several important findings were obtained in this research. In the

initial ability test (pre-test), the analysis results showed that there was no significant difference between the control class and the experimental class with a calculated t value of -1.87 and significance 0.064 (>0.05). This shows that the initial abilities of students in both groups were relatively equal before being given treatment.

Furthermore, the results of the Paired Sample t-test test in the control class showed a significant difference between the pre-test and post-test with a calculated t value of -12.45 and a significance of 0.000 (<0.05). This shows that despite the use of conventional learning, there is an improvement in the ability to analyze student argumentation texts. Similarly, in the experimental class, the test results showed a calculated t-value of -18.76 with a significance of 0.000 (<0.05), which means that there was a significant improvement after the application of the Problem-Based Learning model.

In the final result comparison test (post-test), a calculated t-value of -13.21 with a significance of 0.000 (<0.05) was obtained. These results indicate that there are significant differences between the control class and the experimental class after the treatment has been administered. The average analytical ability of the argumentation text in the experimental class (86.9) was higher than in the control class (79.7). Thus, it can be concluded that the application of the Problem-Based Learning model has a more effective influence on improving students' argumentation text analysis skills compared to conventional learning.

The results of the study were not only analysed using inferential statistical tests, but also reinforced by analysis N-Gain score and effect size (Cohen's d) to determine the practical effectiveness of learning and the strength of the model's influence *Problem-Based Learning* on students' argumentation text analysis skills.

Based on the results of the N-Gain calculation, the control class obtained a value of 0.26 which was in the low category. Below is presented a graph of the N-Gain distribution for the control class.

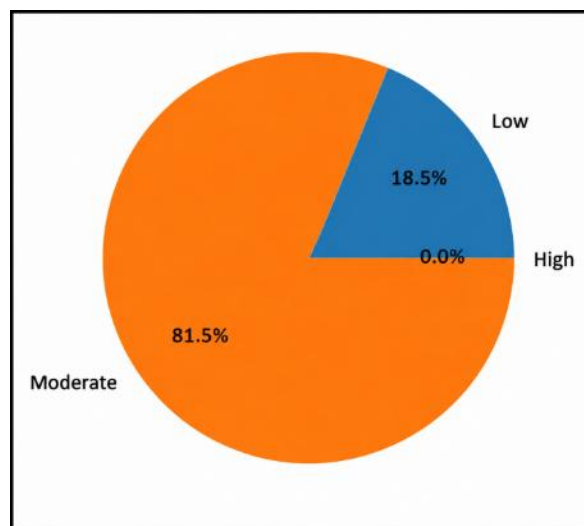


Figure 1. Distribution of Student N-Gain in Control Classes

In the experimental class, it obtained an N-Gain value of 0.52 which was in the moderate category. This suggests that the improved capabilities in the experimental class are more optimal than in the control class. Below is presented a graph of the N-Gain distribution for the experimental class.

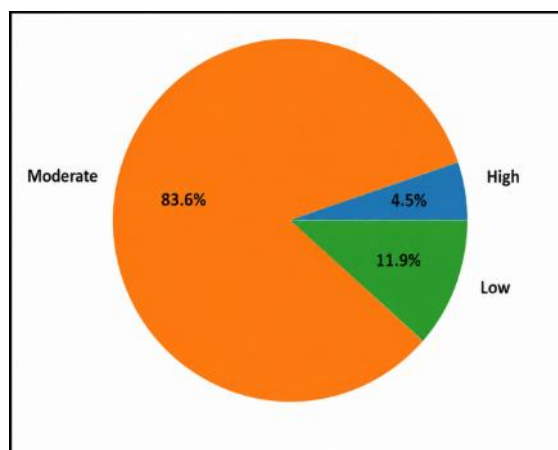


Figure 2. Distribution of Student N-Gain in Experiment Classes

In addition, based on the results of the calculations effect size using Cohen's d a value of 2.94, which falls into the category very big. This suggests that the use of E-LKPD is based on Project Based Learning has a very strong influence on improving students' learning outcomes. Thus, the improvements that occur are not only statistically significant, but also have a high practical impact on the learning process. These findings indicate that the application of *Problem-Based Learning* has a very strong practical influence in improving students' argumentation text analysis skills.

Table 8. N-Gain and Effect Size Analysis Results

Class	Mean Pre-test	Mean Post-test	N-Gain	N-gain Category	Cohen's d	Effect Size Category
Control	70,2	79,7	0.26	Low	-	-
Experiment	72,8	86,9	0.52	Moderate	2.94	Very Large (Very Strong)

Based on these results, it can be concluded that the improvement in the analytical ability of argumentation texts in the experimental class was not only higher on average, but also showed a very strong learning effectiveness in practical terms. This finding reinforces the results of the Independent Sample t -test test, which previously showed significant differences between the control class and the experimental class, so that it can be stated that the model *Problem-Based Learning* more effective than conventional learning.

4. Discussion

The results show that Problem-Based Learning (PBL) was more effective than conventional instruction in developing students' ability to analyse argumentative texts. Although the two groups began with comparable levels of ability, as indicated by the no significant difference in their pre-test scores (Sig. = 0.064), their performance diverged after the intervention (Sig. = 0.000). The experimental group also achieved a higher N-Gain (0.52) than the control group (0.26), while the Cohen's d value of 2.94 indicates a very large difference between the groups. Rather than viewing

these results only as evidence of statistical significance, they can be understood in relation to the type of learning experience provided through PBL. The improvement suggests that students benefited from a learning environment in which they were consistently required to examine information, evaluate evidence, question reasoning, and justify their interpretations. These activities are central to argumentative-text analysis and are also closely related to higher-order thinking.

One reason PBL appears to have worked well in this context is the close match between what students were asked to do during learning and what they were expected to demonstrate in the assessment. Understanding an argumentative text requires more than locating information that is explicitly stated. Students need to recognize the writer's claim, determine the reasons supporting that claim, examine the evidence used, and consider whether the conclusion follows logically from the available evidence. In this sense, argumentative-text analysis involves a progression from comprehension to analysis and evaluation. Akib et al. (2024); Muhsin et al. (2024) similarly emphasize that argumentation requires students to organize reasoning, assess evidence, and establish meaningful relationships among argumentative elements. The stronger performance of students in the PBL group can therefore be interpreted as the result of repeated engagement with these processes rather than simply increased exposure to argumentative texts.

The structure of the intervention provides further insight into how this improvement may have occurred. The five stages used in the study, problem orientation, group organization, investigation, presentation of analytical findings, and reflection and evaluation, created a learning sequence in which students progressively developed and tested their interpretations. Instead of receiving an immediate explanation of how an argumentative text should be analysed, students were first confronted with a problem and encouraged to identify the central issue. They then investigated the text by examining claims, reasons, evidence, and conclusions and by considering the relationships among them. As the analysis developed, students had to determine whether the evidence was relevant and sufficient and whether the reasoning was logically coherent. The process culminated in the presentation and defence of their interpretations. In this way, students were not simply learning the terminology of argumentation; they were using that knowledge to make and justify analytical judgments.

This pattern is consistent with the cognitive engagement that underlies PBL. The model places learners in situations where they must construct understanding through investigation and problem solving rather than simply receive information from the lecturer. Liu & Pásztor (2022) in a meta-analysis of 50 empirical studies involving 5,210 participants, reported positive effects of PBL on critical-thinking skills and dispositions in higher education. At the same time, they emphasized that the effectiveness of PBL is influenced by factors such as treatment duration, group size, student characteristics, disciplinary context, and instructional design. This qualification is particularly relevant to the present study. The substantial improvement observed here should not be attributed to the use of PBL as a label alone. More plausibly, it resulted from the deliberate design of the learning activities around the specific cognitive demands of argumentative-text analysis. In other words, the present results suggest that the effectiveness of PBL depends not only on presenting students with problems but also on how those problems are structured to stimulate particular forms of reasoning.

The results also resonate with international research on PBL and higher-order learning in language education. Orhan (2024) reported that both online and face-to-face PBL improved reading comprehension, critical-thinking skills, and critical-thinking dispositions among university EFL students compared with conventional instructor-led learning. There is an important conceptual connection between that study and the present research. Both require students to move beyond literal comprehension and engage in critical examination of information. However, argumentative-text analysis involves an additional layer of reasoning because students must determine how claims, evidence, reasons, and conclusions are connected and whether those relationships are sufficiently justified. Thus, while Orhan's findings demonstrate the broader potential of PBL for supporting critical reading and critical thinking, the present study provides more focused evidence regarding its application to the analysis of argumentative discourse.

A similar pattern can be seen in the systematic review by Guo et al. (2024) which examined 27 studies of PBL in EFL learning and found positive effects on academic performance, learning behaviour, and critical thinking. Their review suggests that PBL can be effectively incorporated into language-learning environments rather than being restricted to content-based or professional disciplines. The present findings build on this evidence by examining PBL in Indonesian academic language learning and by using argumentative-text analysis as the specific learning outcome. This distinction matters because general improvement in critical thinking does not necessarily mean that students have acquired the ability to systematically deconstruct an argumentative text. The results of this study suggest that PBL can be deliberately adapted to develop this more specific form of academic literacy.

The collaborative dimension of PBL may also help explain the improvement observed in the experimental group. During group investigation, students encountered interpretations that did not always coincide with their own. When disagreement occurred, they had to explain the basis of their interpretation and refer to evidence in the text. Such interaction encouraged students to make their reasoning visible to others. More importantly, it created opportunities for them to recognize that an interpretation that initially seemed convincing might not be sufficiently supported by textual evidence. Collaboration therefore served a cognitive function rather than merely organizing students into groups. It created a social setting in which interpretations could be questioned, compared, and revised. This is particularly relevant to argumentative-text analysis because students need to distinguish between what they personally believe and what can be justified from the evidence presented in the text.

The presentation stage reinforced this process by requiring students to communicate and defend their analytical conclusions. When students explained their findings to their peers, they had to clarify how they arrived at a particular interpretation and why the evidence supported their conclusion. Questions from other groups created additional opportunities to reconsider assumptions and identify gaps in reasoning. This process is consistent with Kleemola et al. (2022); Wang & Newell (2025) who emphasized that argumentation in higher education involves taking positions, considering alternative perspectives, and supporting claims with evidence. The distinctive contribution of the present study is that these processes were applied to the analysis of arguments produced by other writers, rather than being limited to the construction of students' own argumentative texts.

Reflection provided another important layer of learning. After completing their analysis, students were encouraged to reconsider the reasoning behind their conclusions and assess whether those conclusions were adequately supported. This process moves students beyond simply arriving at an answer and encourages them to examine the quality of the reasoning that led to that answer. Such reflection is particularly valuable in argumentative-text analysis because an interpretation may appear plausible while still resting on weak evidence or an incomplete understanding of the relationship between claims and reasons. By revisiting their analytical decisions, students had opportunities to identify unsupported interpretations, reconsider weak reasoning, and revise their conclusions. PBL therefore incorporated a metacognitive element that may have contributed to the stronger development of analytical competence.

The improvement observed in the control group should also be acknowledged. Conventional instruction was not ineffective; students in this group still demonstrated progress, reflected in an N-Gain of 0.26. However, their improvement was considerably smaller than that of the experimental group. One possible explanation is that conventional instruction provided students with knowledge about argumentative structures and analytical procedures but fewer opportunities to use those procedures repeatedly in situations that required independent reasoning. Knowing that an argumentative text contains claims, reasons, and evidence does not necessarily mean that students can determine whether the evidence is relevant, whether the reasoning is coherent, or whether the conclusion is justified. PBL placed greater emphasis on applying these concepts while students investigated problems, compared interpretations, evaluated evidence, and defended their conclusions. The difference between the groups may therefore reflect differences in the quality of cognitive engagement rather than simply differences in the amount of instructional content.

This interpretation is also consistent with Liu & Pásztor (2022), observation that PBL outcomes vary according to implementation conditions. The very large Cohen's d value observed in this study should consequently be interpreted with some caution. A large educational effect can be influenced by characteristics of the participants, intervention duration, assessment design, and the extent to which instructional activities correspond to the measured outcome. In this study, there was a particularly strong alignment between the intervention and the assessment. Students repeatedly practiced identifying argumentative structures, examining logical relationships, evaluating evidence, recognizing weaknesses, and drawing conclusions, and these same competencies were assessed after the intervention. This alignment may have contributed to the magnitude of the observed effect. The effect size therefore provides strong evidence of the value of PBL within the context examined here, but it should not be interpreted as an effect that can automatically be expected in every PBL implementation.

The pattern of improvement is more informative when the inferential and descriptive results are considered together rather than discussed separately. The higher N-Gain achieved by the experimental group, combined with the significant post-test difference and the large effect size, points to a consistent pattern of improvement following the intervention. The statistical results establish that the groups differed after treatment, while the analysis of the learning process provides a plausible explanation for why that difference emerged. This distinction is important because statistical significance alone does not explain the educational mechanism behind an observed effect.

In the present study, the mechanism appears to be related to sustained engagement in investigation, evidence-based reasoning, discussion, justification, and reflection.

The focus on non-language university students further strengthens the significance of these findings. Previous research on PBL in language education has commonly examined broad outcomes such as critical thinking, reading comprehension, language proficiency, or argumentative writing (Guo et al., 2024; Orhan, 2024). These outcomes are important, but they do not fully capture the ability to analyze an argument that has already been constructed by another writer. Students outside language-related disciplines regularly encounter argumentative discourse in academic articles, reports, policy discussions, and disciplinary literature. They therefore need to be able to identify claims, examine evidence, evaluate reasoning, and determine whether conclusions are adequately supported, even though language and rhetorical analysis may not constitute the central focus of their disciplinary education.

This context gives the present study a particular contribution. Non-language students may have fewer opportunities for explicit instruction in rhetorical structures and argument analysis than students majoring in language or language education. PBL offers a way of embedding these skills within meaningful problems rather than treating argumentative-text analysis as a narrowly linguistic exercise. In the intervention, students were required to investigate textual problems, compare interpretations, evaluate information, and justify their conclusions. Such activities brought academic language learning into contact with the kinds of reasoning students encounter in their other areas of study. PBL may therefore function as a bridge between language learning and disciplinary reasoning, particularly for students whose primary field lies outside language studies.

The findings also contribute to a more specific understanding of why PBL may support analytical competence. Previous research has generally associated PBL with problem solving, collaboration, critical thinking, learner autonomy, and active engagement (Guo et al., 2024; Liu & Pásztor, 2022). In the context of argumentative-text analysis, these broad mechanisms can be understood more specifically as a sequence of reasoning activities: identifying a problem, investigating evidence, comparing interpretations, evaluating the adequacy of reasoning, communicating an analytical position, and reconsidering the conclusion. The value of PBL, therefore, may not lie simply in making students more active. Its stronger contribution comes from organizing that activity around cognitive operations that closely resemble the processes involved in competent argument analysis.

The findings are likewise compatible with research emphasizing the relationship between argumentation and critical thinking. Akib et al. (2024); Muhsin et al. (2024) reported that students often experience difficulties in organizing reasoning and evaluating evidence when constructing argumentative texts. Chen et al. (2025); Wang & Newell (2025) further showed that critical inquiry, collaboration, and argument-focused instruction can support students' critical thinking and argumentation. The present study complements this body of research by shifting attention from the production of arguments to the examination of arguments. This distinction is theoretically relevant because academic literacy requires both abilities. Students need to construct arguments that can withstand scrutiny, but they also need to critically examine the arguments they encounter in academic and disciplinary contexts.

From a pedagogical perspective, the findings suggest that argumentative-text instruction may benefit from being organized around meaningful analytical problems rather than relying primarily on explanations of textual structures and routine comprehension questions. Students can be challenged to determine why an argument is convincing or problematic, whether its evidence is sufficient, how competing interpretations differ, and whether a conclusion can reasonably be derived from the available evidence. At the same time, effective PBL requires careful instructional design. The problems should be sufficiently meaningful to stimulate inquiry, group activities should encourage genuine exchange of reasoning rather than simple division of tasks, and assessment should correspond to the analytical processes that students are expected to develop.

Overall, the results suggest that PBL was effective in this study because its instructional processes closely matched the cognitive demands of argumentative-text analysis. Problem orientation encouraged students to identify issues, investigation required them to examine claims and evidence, collaboration exposed them to alternative interpretations, presentation required them to justify their analytical decisions, and reflection encouraged them to reconsider the adequacy of their reasoning. These interconnected activities gave students repeated opportunities to practice the competencies assessed in the study. The improvement observed in the experimental group can therefore be understood not simply as the result of replacing one teaching model with another, but as the consequence of creating sustained opportunities for students to engage in analytical reasoning.

The principal contribution of this study lies in bringing together three areas that have often been examined separately: problem-based learning, academic language learning, and argumentative-text analysis. Previous studies have established the potential of PBL for developing critical thinking and language-related outcomes, but comparatively less attention has been given to its role in developing students' ability to deconstruct and evaluate existing argumentative texts, particularly among non-language university students. The present findings provide evidence that PBL can be used not only as a general active-learning model but also as a deliberately structured approach for developing higher-order analytical competence in academic language learning.

5. Conclusion

This study found that Problem-Based Learning (PBL) was effective in improving the argumentative-text analysis skills of non-language university students. Although both groups showed improvement after the intervention, students who participated in PBL made greater progress than those who received conventional instruction, as reflected in the higher N-Gain score of the experimental group (0.52) compared with the control group (0.26) and the large effect size (Cohen's $d = 2.94$). These findings suggest that PBL can provide students with meaningful opportunities to examine arguments, evaluate evidence, consider different interpretations, and develop well-supported conclusions. From a theoretical perspective, the study extends previous research on PBL by showing that its contribution can be applied to a more specific form of higher-order learning, namely the analysis and evaluation of existing argumentative texts. This finding is particularly relevant for non-language students, who need academic literacy skills even though language and rhetorical analysis are not the primary focus of their study programs. In practice, PBL can be considered an alternative approach for academic Indonesian language courses that aim to

strengthen students' analytical and evaluative abilities. Future research should examine the implementation of PBL in different universities, disciplines, and student groups, and should consider longer intervention periods as well as qualitative or mixed-method approaches to better understand how students develop argumentative-text analysis skills throughout the learning process.

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