Vol. 15, No. 04, pp. 2463-2482, 2025 DOI: 10.23960/jpp.v15i4.pp2463-2482

Jurnal Pendidikan Progresif

e-ISSN: 2550-1313 | p-ISSN: 2087-9849

http://jpp.fkip.unila.ac.id/index.php/jpp/

Problem-Based Learning vs Inquiry Learning: Strategies to Improve Students' Sociological Literacy and Critical Thinking Skills

Esa El Hawa*, Wilodati, & Siti Komariah

Department of Sociology Education, Universitas Pendidikan Indonesia, Indonesia

*Corresponding email: esaelhawa20@gmail.com

Received: 31 October 2025 *Accepted: 03 December 2025* *Published: 11 December 2025*

Abstract: Problem-Based Learning vs Inquiry Learning: Strategies to Improve Students' Sociological Literacy and Critical Thinking Skills. Objective: This study aims to analyze the comparative effectiveness of the Problem-Based Learning (PBL) and Inquiry Learning (IL) models in improving the Sociological Literacy and Critical Thinking Skills of high school students, as well as to explore the significant contribution of the comparison of these two models to the sociological pedagogical literature in the 21st century. **Methods:** This study used a quasi-experimental design with a quantitative approach, involving two randomly selected treatment groups from grade XI students. The total number of research participants was 72 students. The main instruments used were pretest and posttest measures of Sociology Literacy (30 multiple-choice questions) and Critical Thinking Skills (7 essay questions). Inferential data analysis was carried out using Covariance Analysis (ANCOVA) with pretest scores as covariates. The use of ANCOVA is essential to statistically control differences in students' initial abilities and validate the pure impact of the learning model. **Findings:** The results showed that the PBL Model was significantly more effective ($p < 0.05$) in improving Sociological Literacy and Critical Thinking Skills compared to the IL Model. This advantage was confirmed by the substantially higher adjusted average (Adjusted Marginal Means) in the PBL group for both outcome variables. Conceptually, these findings show a superior fit between the directional problem-solving framework in PBL and the demands of complex sociological reasoning. **Conclusion:** Problem-Based Learning is the most effective instructional strategy for cultivating analytical skills and critical thinking in the context of Sociology. The PBL model is successful because its directional scaffolding structure and cognitive conflict are more effective in training critical sub-skills such as contextual analysis and evidence-based decision-making. This study recommends the sustainable adoption of PBL by Sociology teachers to foster robust learning that aligns with the demands of global socio-analytical competencies.

Keywords: problem-based learning, inquiry learning, sociological literacy, critical thinking, 21st century.

To cite this article:

Hawa, E. E., Wilodati, & Komariah, S. (2025). Problem-Based Learning vs Inquiry Learning: Strategies to Improve Students' Sociological Literacy and Critical Thinking Skills. *Jurnal Pendidikan Progresif*, *15*(4), 2463-2482. doi: 10.23960/jpp.v15i4.pp2463-2482.

INTRODUCTION

Education at the high school level is now facing a profound structural transformation, driven by the intensification of globalization and a shift in the technological paradigm towards the Industrial 4.0 revolution. These fundamental changes have overhauled the labor market and civic life, demanding a different adaptation of Human *Capital*, which is no longer enough to rely solely on mastery of traditional curricula (Rahimi & Oh, 2024; Serdinova, 2024). As a result, global educational institutions are urged to shift from a focus on passive material transmission to the development of 21st-century competencies

that are functional and applicable. These core competencies, known as the 4C skills of *critical thinking*, *creativity*, *communication*, and *collaboration*, are considered the main prerequisites for academic success and professional survival (Heard et al., 2025). Methodologically, this shift is characterized by the adoption of approaches such as *Inquiry-Based Learning*, which effectively develops 4C skills from theory to practice (Chu et al., 2021). In addition to the 4Cs, mastery of digital literacy and high-level thinking skills (HOTS) are essential functional skills. Specifically, research shows that HOTS, especially metacognitive abilities, play a significant role in shaping student learning outcomes, which are crucial for students to live productively and adaptively in an information-dominated environment (Prusty et al., 2024). The 21st Century Skills Framework, developed by P21, emphasizes that integrating the 4Cs into curriculum and pedagogy is key to helping students compete globally.

This shift in focus towards developing high-level cognitive abilities has become a national strategic policy agenda in many countries, including Indonesia. This change is driven by the reconstruction of globally assessed skills, as reflected in international assessment instruments such as PISA (Programme for International Student Assessment), which explicitly tests competencies such as creativity and critical thinking (Grey & Morris, 2024). The Government of Indonesia, through the Ministry of Education, Culture, Research, and Technology (Kemdikbudristek), has compiled a Pancasila Student Profile. In the profile, it is explicitly stated that the ability to reason critically and creatively is an aspect of character expected of students (Misyani et al., 2025). This national strategic commitment aligns with global demands, as evidenced by the trend of education reform and curriculum changes driven by digital technologies (Wang et al., 2024). Therefore, the Pancasila Student Profile not only aims to foster local character but also ensures that the young generation of Indonesia has a solid cognitive foundation and character to compete and adapt on the global stage.

Critical reasoning skills include complex cognitive measures such as deep analysis, objective evaluation, and self-reflection on information (Meirbekov, Maslova & Gallyamova, 2022). However, the strength of the synthesis argument suggests that these high-level cognitive skills are inaccessible without a strong foundation: Critical Literacy. Literacy is no longer understood as a basic reading ability, but rather as a complex, strategic ability to understand, interpret, and evaluate the validity of sources, and to integrate texts, data, and narratives from various media to form deep insights and knowledge constructions (Maor et al., 2023). This critical literacy is very important in the social sciences, as it provides an initial ability to evaluate biases, interpret social data, and understand social structures, which are at the core of sociological literacy (Nousak, Barry & Fisk, 2024). Strategically, increased literacy serves as an essential catalyst for the development of high-level thinking (HOTS), as the ability to efficiently process and evaluate information is a prerequisite for analyzing and evaluating (Ossa, Rivas, & Saiz, 2023). Thus, strengthening literacy and critical thinking skills is an integral part of the national education strategy in preparing a reflective, adaptive, and competitive generation at the global level.

In the context of sociology learning, the two main skills highly relevant to these demands are Sociological literacy and critical thinking. Sociological Literacy must be operationalized as a high-level cognitive ability, with Sociological *Imagination* as its main focus. The sociological imagination serves as a tool for students to understand the mutual relationship between their private experiences (private troubles) and public issues (public issues), influenced by social,

historical, and political structures (Watson, 2018). Thus, Sociological Literacy is specifically centered on understanding the social structures underlying social phenomena and the ability to critically analyze social data to interpret reality (Ferguson & Sweet, 2023). This ability is closely related to Critical Thinking, which is the ability to analyze and evaluate information and draw logical conclusions (Pettersson, 2023). In the operational context of this study, Critical Thinking refers to a directed cognitive process that involves a set of measurable skills. Preferred components include argument analysis (the ability to identify reasons and claims), evidence evaluation (the ability to assess the credibility and relevance of information), and inference (the ability to draw logical and reasoned conclusions from available evidence) (Kozikoglu, 2019). These two abilities reinforce each other because they require students to understand, interpret, and evaluate social phenomena in depth, drawing on theoretical foundations and empirical evidence.

The pedagogical challenge of developing Higher Order Thinking Skills (HOTS) in Indonesia has reached a tipping point, as confirmed by global data. According to the Programme for International Student Assessment (PISA) 2022, the minimum proficiency level of Indonesian students is low: only 25% in reading literacy and 18% in mathematics. These figures are well below the average of OECD (Organization for Economic Co-operation and Development) countries, where around 69-76% of students achieve the minimum proficiency level (OECD, 2023). This PISA data provides macro-level evidence of systemic and fundamental weaknesses in Indonesian students' analytical and critical reasoning abilities in solving problems grounded in social contexts.

The national crisis in HOTS, as reflected in PISA, manifests in specific ways at the local level. The failure of HOTS in PISA reflects students' limited ability to transfer conceptual understanding to analyze contextual problems, a core weakness in critical reasoning in the Social Sciences (OECD, 2023). This finding was confirmed through initial observation and qualitative analysis of student performance in the SMAN 1 Sumbawa Besar class. This observation was made by the researcher when he went directly into the field to verify the actual conditions of learning and confirm the problems identified. The results of the qualitative analysis show the same pattern of weaknesses, which are micro-manifested as low sociological literacy and students' critical thinking skills. An indication of this limitation is evident when students struggle to analyze social structures and associate observed social phenomena with the theoretical foundations of sociology. They tend to accept social information without critical reflection passively, participate in discussions, and are not accustomed to crafting arguments based on valid data.

This condition is reinforced by the international sociological education literature. The study by Howard (2023) highlights that most students have difficulty understanding the main themes in sociology, especially those related to social change and social reproduction, which are essential for analyzing contemporary social phenomena. Furthermore, Nousak, Barry, & Fisk (2024) noted that weak sociological literacy is also associated with students' limited ability to critically understand social data, especially in the use of evidence-based approaches. This weakness is exacerbated by learning practices dominated by traditional methods. Walter (2024) emphatically emphasizes that critical thinking skills will not develop automatically in traditional learning, but must be explicitly designed through learning strategies that encourage exploration, discussion, and reflection. Thus, pedagogical intervention at SMAN 1 Sumbawa Besar is a direct response to the national failure to achieve the HOTS (PISA) standard, as evidenced by students' sociological literacy.

The limitations in students' ability to analyze social phenomena are allegedly strongly influenced by the dominance of conventional, teacher-centered learning methods (Handayani et al., 2023). This method, which generally emphasizes one-way lectures, memorization, and knowledge transfer, has been empirically shown to limit students' active engagement in analytical and reflective discussions (Murphy, Eduljee & Croteau, 2021). The role of students is reduced to passive recipients, denied the opportunity to engage in critical thinking or to explore sociological concepts independently. In the context of sociology, empirical studies show that classes that use conventional methods produce low levels of sociological literacy, characterized by students' inability to connect personal phenomena with broader social issues (Watson, 2018).

Furthermore, in the context of sociology, conventional methods have proven ineffective in developing sociological literacy and critical thinking. Dessingué and Wagner (2025) assert that effective teaching practices to foster critical thinking must be dialogical, interactive, and analysis-based, which is empirically not achieved in conventional lecture-based models. The failure to cultivate sociological literacy is due to a lack of emphasis on in-depth social analysis skills. Conventional models often fail to facilitate the active engagement necessary to activate Howard's (2023) Sociological Imagination, an essential ability to connect personal issues with larger social structures and a key foundation of sociological literacy (Watson, 2018). This condition underscores the urgency of implementing innovative, active, collaborative, and problem-based learning models, which are empirically proven to improve students' sociological literacy and critical thinking skills, compared with conventional, passive, teacher-centric models (Anggraeni et al., 2023; Grant, Swan & Lee, 2022).

To address challenges in learning in the 21st century, the two learning models considered most effective in fostering high-level competencies are Problem-Based Learning (PBL) and Inquiry Learning (IL). The Problem-Based Learning model is a structured learning framework in which students are confronted with authentic, ill-structured problems relevant to daily life or social phenomena. This approach inherently demands collaboration, discussion, and critical thinking skills to evaluate the solutions they find (Thompson, 2019). The success of PBL, as emphasized by Sain & Sain (2025), lies not only in cognitive outcomes but also in the meaningful learning process, which is crucial for developing students' analytical, collaborative, and reflective skills. Several international studies support that PBL significantly improves students' sociological literacy and critical thinking skills. For example, Anggraeni et al. (2023) in Thinking Skills and Creativity found that PBL consistently improves students' critical thinking skills through a problem-based approach relevant to the social context. In addition, Yu & Zin (2023) affirm that adaptations of Problem-Based Learning that focus on critical thinking directly encourage students to analyze social phenomena, evaluate evidence, and draw conclusions reflectively, which are core components of sociological literacy.

On the other hand, Inquiry Learning emphasizes self-exploration and evidence-based investigation (Hwang, Chiu, & Chen, 2015). The Inquiry Learning Model directly directs students to formulate questions, investigate phenomena, and draw conclusions based on the empirical data they collect, mimicking the process of scientific research (Acar & Tuncdogan, 2018). Several international studies consistently support the effectiveness of the Inquiry Learning model in improving students' critical thinking and social literacy skills. For example, Duran and Dökme (2016) found that inquiry-based learning approaches have a positive and significant impact

on students' critical thinking skills. Furthermore, Summerlee (2018) emphasized that Inquiry-Based Learning is a socially equitable approach in higher education that can encourage deep social reflection and understanding. Specifically in the context of Social Sciences, Inquiry Learning has been shown to train students to think scientifically through activities such as formulating hypotheses, testing data, and drawing conclusions based on social evidence, which is at the core of sociological literacy or social reflection (Grant, Swan, & Lee, 2022).

Theoretically, Problem-Based Learning and Inquiry Learning both have the potential to improve students' sociological literacy and critical thinking skills (Anggraeni et al., 2023; Duran & Dökme, 2016). However, critical synthesis reveals a fundamental difference between its theoretical roots and its pedagogical focus. The Problem-Based Learning model is rooted in constructivist theory and focuses the learning process more on authentic, ill-structured, contextual problem-solving. This model trains students to identify the root of social problems, evaluate practical solutions, and make informed decisions, a process that is highly relevant to the practical aspects of sociology. On the other hand, Inquiry Learning is rooted in the tradition of scientific research and is centered on the process of scientific investigation. This model trains students to formulate hypotheses, collect empirical data, and draw evidence-based conclusions, a process that replicates social research methodologies. This difference in theoretical focus makes the comparison of the two essential in sociology. This discipline inherently demands two abilities: (1) contextual understanding and social problem-solving, and (2) evidence-based empirical investigation. Sociology, which is focused on activating the sociological imagination (Mills, 2023), requires students to connect private troubles with public issues. Problem-Based Learning effectively touches on aspects of contextual understanding and troubleshooting of social problems (Sain & Sain, 2024), while Inquiry Learning provides a solid foundation for students to analyze data, validate sociological evidence, and mimic the process of scientific investigation, which is a vital component of comprehensive sociological literacy (Grant, Swan, & Lee, 2022). Therefore, determining which model is superior at cultivating these two abilities is the main justification for comparing the Problem-Based Learning and Inquiry Learning models in the context of sociology.

A systematic literature review shows that, although the Problem Based Learning and Inquiry Learning models have been extensively researched and their effectiveness confirmed in the fields of Science, Mathematics, and STEM in general (Ješková et al., 2016; Lee, Capraro & Bicer, 2019; Oliver, McConney & Woods, 2021), and even comparative studies between different inquiry approaches have been conducted (Tawfik, Hung, & Giabbanelli, 2020), studies that directly compare the comparative effectiveness of Problem Based Learning versus Inquiry Learning in the pedagogical domain of Social Sciences or Sociology specifically are still very limited. There has been no systematic review that addresses this thoroughly. These limitations create significant empirical gaps. Therefore, this research aims to fill this gap by providing pioneering empirical data that is not only locally relevant but can also contribute to the development of Social Science pedagogy globally, including curriculum development, teaching strategies, and evaluation methods.

The limitations of research that directly compares the effectiveness of the two models in a sociological context are the main justification for this study. This study uses SMAN 1 Sumbawa Besar as a test case. However, its main focus is to provide empirical evidence that can serve as a reference for developing sociological learning models relevant to the demands of the 21st century across various educational contexts. The aim is to identify the most effective learning models

for improving students' sociological literacy and critical thinking skills, thereby contributing to the broader social science pedagogical discourse and serving as a basis for developing a methodological framework for sociology educators at the global level.

METHOD

Participants

The population of this study comprises all students in class XI IPS at SMAN 1 Sumbawa Besar, totaling 108 students across three parallel classes. The sample consisted of two classes, XI IPS 1 and XI IPS 3, totaling 72 students. Because class divisions are fixed and randomization at the individual level is not possible (*pre-existing groups*), class selection is conducted using convenience sampling. The selection of classes XI IPS 1 and XI IPS 3 was based on availability and practical considerations in the field, while taking into account the proximity of the Sociology Mid-Semester Assessment (PTS) score as an initial criterion to ensure that both classes have a comparable general academic profile. Although the sampling technique used was convenient, the equivalence of the experimental groups was validated and empirically confirmed through the pretest scores of the research instruments.

As a basis for selecting the research sample class, the average PTS Sociology score across the three classes was examined. The average PTS score in both classes is relatively close, namely 72.41 for XI IPS 1 and 73.16 for XI IPS 3. This average proximity indicates that the basic academic abilities of students in both classes do not have a marked difference. Class XI IPS 2 has a higher average (76.72), so it was not selected as a sample because the initial ability difference is quite large and could bias the quasi-experimental design.

To ensure that the two classes have equal initial abilities, statistical analysis was conducted using normality and homogeneity tests on the PTS scores. The Normality Test results showed p-values of 0.200 in both classes, which were above the significance threshold of 0.05. This value indicates that the distributions of PTS grades in both classes follow a normal distribution. This condition of normality is important because it shows that the value of private universities does not experience extreme scarcity and is distributed in a reasonable manner, allowing the characteristics of students' initial abilities to be compared fairly. Normality also ensures that the basic assumptions of parametric statistical analysis are met, including suitability for intergroup equivalence tests in *quasi-experimental designs*.

Furthermore, the Variance Homogeneity Test using Levene's Test showed a p-value of 0.430, which is also greater than 0.05. These results show that the variance in the PTS values across both classes is homogeneous. This homogeneity of variance is an important aspect of comparative research because it indicates that the distribution of students' initial abilities across the two classes is not significantly different. With comparable variance, the difference in initial ability between classes does not affect the treatment results, so any change in grades at the *posttest stage* can be more likely a direct result of differences in the learning model applied, rather than an imbalance in initial variance.

Methodologically, the fulfillment of the assumptions of normality and homogeneity provides a strong justification that the two classes are in an equal initial condition, even though the class selection is not carried out randomly. This is especially important in *the design of non-equivalent control groups*, where initial equivalence between groups is the primary requirement for comparative validity. Thus, both classes are suitable for use as research samples, and the research results can be interpreted more accurately.

Research Design and Procedures:

This study used a quasi-experimental design with a non-equivalent control group and a

pretest–posttest. Two classes were selected as experimental groups based on the researchers' consideration of PTS Sociology scores, with class XI IPS 1 designated as an Inquiry Learning class and class XI IPS 3 as a Problem-Based Learning (PBL) class. This determination was made by the researcher because the division of study groups in schools is fixed, preventing randomization of participants. Before treatment, both classes took a pretest to assess their initial levels of sociological literacy and critical thinking.

In this study, the selection of two classes to receive different intervention treatments (PBL and IL) was carried out in two stages of justification. The first stage is administrative: the Mid-Semester Exam (PTS) score for the Sociology subject is used only as an initial basis for the class selection process. This aims to ensure that the two experimental classes selected have, on average, comparable academic profiles, thereby reducing the glaring selection bias before treatment. The second, and most crucial, stage is the validation of group equality: The PTS score is not used as an indicator of the initial ability of sociological literacy or critical thinking. The equality of initial ability between the two experimental groups was empirically validated using pretest scores from sociological literacy and critical thinking instruments specifically designed to reflect the research variables. The use of these relevant pretest instruments ensures that group equivalence is established based on baseline ability measured prior to the intervention, thereby optimally maintaining the internal validity of the quasi-experimental design for comparing the two treatments.

This research series began in January 2025 with preliminary study activities, a literature review, and the preparation and validation of instruments. The learning intervention, as the main stage of data collection, was then carried out over three meetings, each lasting 90 minutes, in September 2025 during the 2025/2026 school year. The material used in both classes is the same topic, namely "Social Groups," so the differences in learning outcomes reflect the influence of the learning model rather than the variety of content. All learning steps are arranged using the same tools, including lesson plans and LKPDs that have been adjusted to the syntax of each model.

As part of the analysis of treatment implementation, observation data on learning implementation were collected using an observation sheet completed by the Sociology subject teacher as an independent observer. The observation sheet consists of indicators that assess the consistency of implementation of the Problem-Based Learning or Inquiry Learning syntax, the level of student activity, the quality of the teacher-student interaction, and the achievement of learning objectives at each stage. Each indicator is rated on a scale of 1–4, where 1 = low, 2 = adequate, 3 = good, and 4 = excellent. The average score is obtained by dividing the total assessment of indicators by the number of indicators, providing a quantitative picture of the level of treatment implementation. The rating categories were determined using a four-point Likert scale (1.00–1.75: low; 1.76–2.50: adequate; 2.51–3.25: good; 3.26–4.00: high), so a score e" 3.26 was categorized as high. These observational data are used to ensure *treatment fidelity*, not as a variable in the main statistical analysis. The results of the observation showed that the implementation of the Problem-Based Learning and Inquiry Learning models was in the high category, with average scores of 3.45–3.72 in the PBL class and 3.30–3.41 in the Inquiry Learning class. The value falls within the "high" category (3.26–4.00), indicating that the learning syntax is being carried out consistently and optimally. Thus, the difference in learning outcomes between groups can be determined by the characteristics of the learning model, not by variations in its implementation.

Although the results of quantitative observations confirm that both models are consistently implemented in the "high" category

(PBL: 3.45–3.72; IL: 3.30–3.41), a review of the observer's narrative field notes reveals clear differences in cognitive focus and the dynamics of class interactions. Field notes from the Problem-Based Learning (PBL) group showed that the discussion was more focused on the process of negotiating solutions and on the in-depth evaluation of various perspectives on the problem, which involved analyzing arguments and drawing contextual conclusions. In contrast, field records in the Inquiry Learning (IL) group showed that student interactions were dominated by data verification and empirical exploration, with students making great effort to gather evidence and validate their hypotheses, a core process of scientific investigation. This qualitatively recorded difference provides strong evidence that the variation in learning outcomes between groups stems from differences in cognitive mechanisms stimulated by the model's syntax, rather than from a failure in implementation (*treatment fidelity*).

Observation activities in the study were conducted in two stages to ensure interventions were implemented consistently and objectively. The first stage is a pre-research observation conducted by an expert lecturer in Sociology to assess the readiness of the learning tool, the feasibility of the model syntax, and the class's initial condition before treatment. This initial observation uses a special observation sheet to validate the learning design. The second stage is observing the Sociology subject teacher's classroom implementation as the researcher applies the learning model. The teacher assesses the researcher's consistency with the syntax of PBL and Inquiry Learning, the level of student involvement, and the dynamics of interaction during the learning process. Teacher observation sheets are different from lecturer observation sheets because they focus on *treatment fidelity* or the implementation of treatment directly. Furthermore, Table 1 compares teacher and student activities in the implementation of the Problem-Based Learning and Inquiry Learning models, according to the syntax of each model.

Instrument

The research instruments consisted of a sociological literacy test, a critical thinking ability

Table 1. Comparison of teacher and student activities in the implementation of the PBL model and inquiry learning

Learning Syntax	Teacher-PBL Activities (XI Social Science 3)	Student Activities-PBL	Teacher-Inquiry Learning Activities (XI Social Science 1)	Student Activities-Inquiry Learning
1. Orientation Problem/ Stimulation	Present a real case of "Social Groups" through short videos or contextual situations.	Listen to case presentations and identify early issues.	Providing stimulus in the form of images, news articles, or social phenomena related to social groups.	Observe stimuli and ask initial questions.
2. Problem Formulation	Guiding students to formulate problems and determine the focus of the investigation.	Formulate the problems to be analyzed in the group.	Directs students to identify variables and simple research questions.	Write and discuss investigative questions.
3. Information Gathering/ Inquiry	Provide problem-based LKPD and data sources.	Searching for information, reading sources, and collecting data from LKPD.	Provide the director's questions to guide the inquiry process.	Conduct investigations, collect data, and record initial findings.

4. Analysis and Discussion	Facilitate group discussions and help students analyze alternative solutions.	Discuss, analyze data, and interpret social phenomena.	Guiding students to compare findings between groups.	Analyze information and make interpretations based on evidence.
5. Solution Development/ Verification	Ask students to develop solutions or arguments based on social data.	Construct solutions, create data-driven arguments.	Validate concepts through clarification and comparison of theory with data.	Verify findings and relate phenomena to sociological theories.
6. Presentation of Results	Organize group presentations and provide feedback.	Present the analysis results and solutions to the class.	Facilitate inquiry results reports.	Display research results and receive feedback.
7. Conclusion	Guides students in identifying learning outcomes and relating them to the core material of "Social Groups".	Draw up joint conclusions related to the concept of social groups.	Directing students to draw conclusions based on the inquiry process.	Draw conclusions based on analysis and research findings.

test, and an observation sheet on learning implementation. The sociology literacy test was developed as a 30-question multiple-choice test based on sociological literacy indicators adapted from Giddens et al. (2009) and on Sociology learning outcomes in the high school curriculum. These indicators include the ability to analyze social structures, relate social phenomena to theories, evaluate social issues, formulate arguments based on empirical data, and apply social values in daily life. The variation in the difficulty level of the questions is arranged according to the Revised Bloom Taxonomy, so that it includes the levels of understanding (C2), applying (C3), and analyzing (C4) in proportion. The critical thinking ability test in this study was developed by referring to the critical thinking ability framework of Ennis (1987), which was then adapted into five operational indicators of interpretation, analysis, evaluation, inference, and explanation to facilitate measurement in the context of sociology learning.

The critical thinking ability test uses seven description questions developed based on the critical thinking framework of Ennis (1987), including indicators of interpretation, analysis, evaluation, inference, and explanation. In addition, the study used an observation sheet to assess the implementation of learning and ensure the suitability of the Problem-Based Learning and Inquiry Learning models in the classroom. The aspects observed included teachers' consistency with the learning syntax, the intensity of teacher-student interaction, student activeness in the investigation and discussion stages, and the overall quality of the learning process. Observations are conducted by collaborating teachers who have understood the syntax of each model, thereby minimizing assessment bias across classes. All instruments underwent validity testing using Product-Moment correlation, reliability testing with Cronbach's Alpha, and a differentiation power and difficulty analysis to ensure their feasibility before use in the study.

Data Analysis

Data analysis was carried out in stages using descriptive and inferential statistical techniques. The value of sociology PTS is used only for administrative purposes, such as ensuring class equality. It is not used as a benchmark for initial ability, as PTS tends to assess mastery of memorization concepts. Therefore, the equivalence of initial abilities across classes is

determined using pretest scores for Sociology Literacy and Critical Thinking, which are specifically designed to measure analytical skills, problem-solving, and argumentation, in line with the research's focus.

Before the hypothesis test, a series of prerequisite assumption tests was conducted. The normality test was conducted using the Kolmogorov-Smirnov test for PTS data (due to the large sample size) and the Shapiro-Wilk test for pretest and posttest data (because the sample size in each class was less than 50 students). The homogeneity-of-variance test between groups was performed using Levene's Test. Once all prerequisite assumptions are met, inferential statistical testing to assess differences in the effectiveness of the learning model is performed using Covariance Analysis (ANCOVA). The use of ANCOVA is essential because it allows researchers to statistically control for students' initial ability (pretest) as a covariate, thereby measuring the pure impact of the Learning Model (Problem-Based Learning vs. *Inquiry Learning*) on *posttest* scores. This approach was chosen to provide a more valid and robust causal conclusion, avoiding the drawbacks of N-Gain or Independent Samples t-test analyses. In addition, the Regression Homogeneity Test was conducted to validate the ANCOVA model. All statistical analyses were carried out using SPSS 26.

■ RESULT AND DISCUSSION

Pretest and Methodological Integrity

The descriptive analysis of the initial data (*pretest*) aims to ensure that the two experimental groups are in equal conditions before the intervention is administered. The results of the pretest show high equality. In Sociology Literacy, the Problem-Based Learning (PBL) group obtained an average of 14.52, and the Inquiry Learning (IL) group 13.97, while in Critical Thinking, the Problem-Based Learning group obtained an average of 58.97, and the Inquiry Learning group 59.36. This very small score difference (0.55 in Sociology Literacy and 0.39 in Critical Thinking) confirms that both groups have an equal baseline, as shown in the bar charts in Figures 1 are 2.

Methodological Integrity of Instruments

Before hypothesis testing, the research instrument's integrity and validity were established through rigorous psychometric testing. In addition to content validity testing by experts, the reliability of the essay instrument was quantitatively assessed using Cronbach's Alpha, which yielded a value of 0.89. This number indicates that the instrument is in the high-reliability category and consistently measures the construct. Furthermore, the empirical validity is strengthened by the analysis of item-total correlations, which show that all items have significant correlation coefficients (r count > r table), indicating that each item effectively contributes to measuring the variables.

Overview of the Final Result (Posttest)

After the three-session learning treatment, *the posttest* results showed substantial improvement in both groups, with the PBL group recording a descriptively higher average score. In Sociological Literacy, PBL obtained an average of 22.67 (IL: 19.33). Similarly, in Critical Thinking, PBL reached an average of 104.44 (IL: 95.69). This difference in raw scores indicates a positive impact from both models. However, the absolute superiority of the PBL group needs to be confirmed through an analysis that strictly controls for students' initial ability. The increase in pretest-to-posttest scores for each model is shown in Figures 1 and 2.

Visualization of Score Distribution (Boxplot)

Data visualization using the Box-and-Whisker Plot (Boxplot) was used to comprehensively compare the distributions of scores, showing medians, interquartile ranges, and

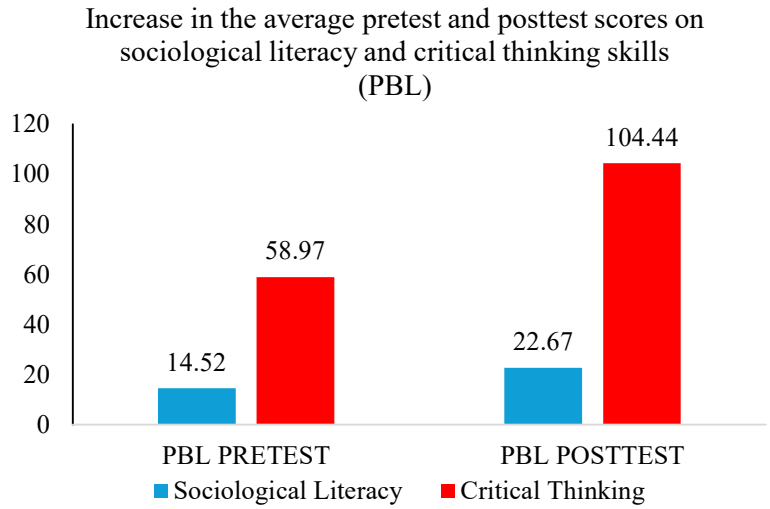

Figure 1. Improvement in the average pretest and posttest scores on sociological literacy and critical thinking skills (PBL)

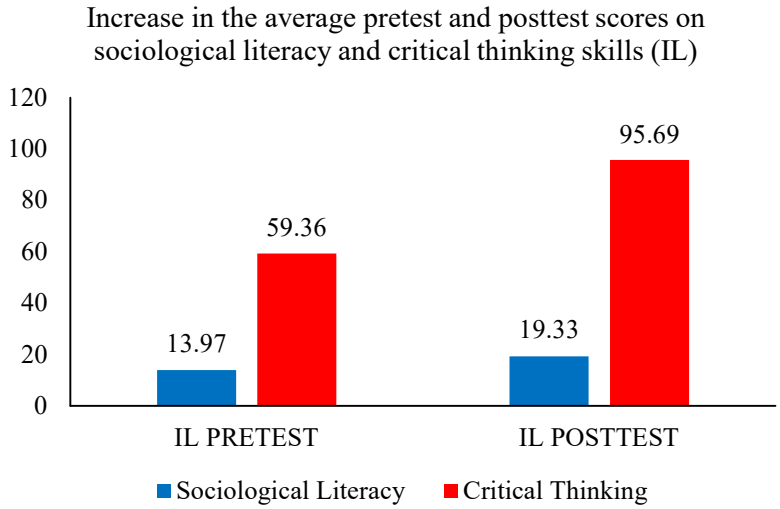

Figure 2. Improvement in average pretest and post-test scores on sociological literacy and critical thinking (IL) skills

outliers between the two groups. The boxplot showed a significant shift in posttest scores toward higher values in both groups compared to the pretest, confirming that the learning interventions were effective in improving learning outcomes. In more detail, the posttest comparison showed that the median (indicated by the line in the middle of the box) of the Problem-Based Learning (PBL) group was consistently higher than that of the Inquiry Learning (IL) group for both variables, indicating a tendency toward better central achievement in PBL. Although the interquartile ranges (box lengths) of the two groups were comparable, the PBL group showed higher whiskers and outliers on the Critical Thinking Ability score, confirming that students in the PBL group achieved higher maximum scores than those in the Inquiry Learning group. Thus, this visualization provides strong descriptive evidence of a shift in the distribution of superior scores and

greater maximum achievement in the group that received the Problem-Based Learning treatment. Presented in Figures 3 and 4.

Comparative Hypothesis Test (ANCOVA)

To validate the use of Covariance Analysis (ANCOVA) as the primary inferential test, a series

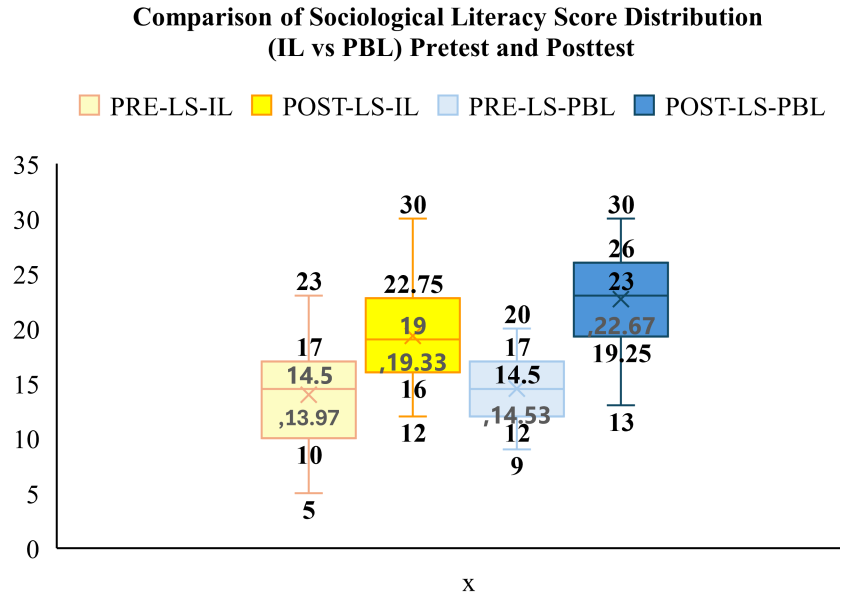

Figure 3. Box and whisker plot data pretest and posttest sociology literacy

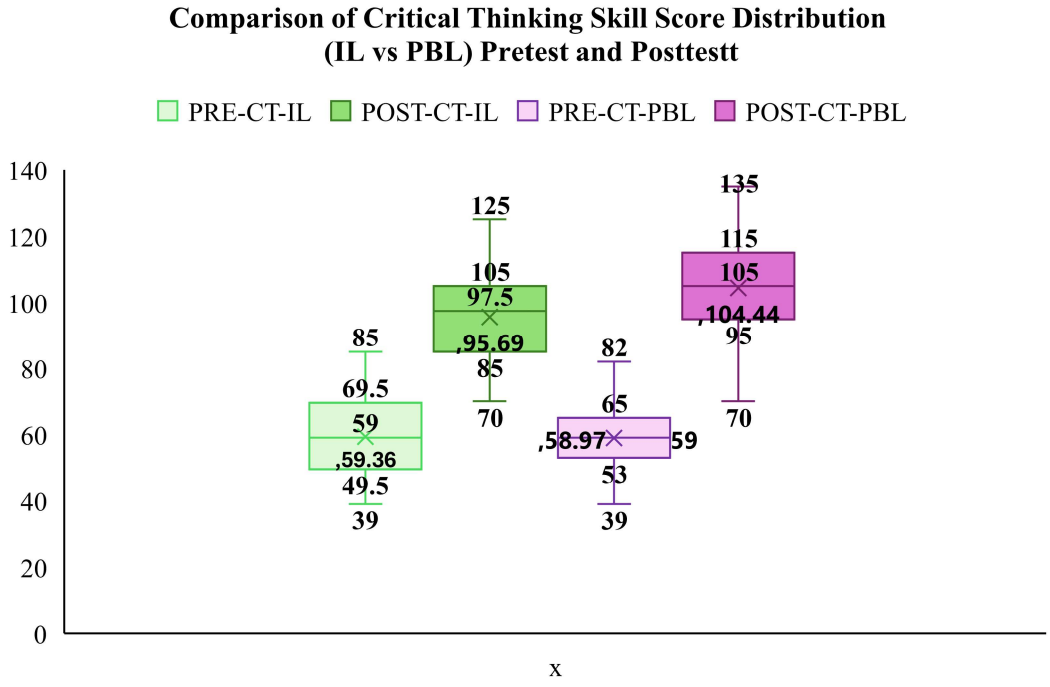

Figure 4. Box and whisker plot: data pretest and posttest critical thinking ability

of prerequisite statistical assumption tests was conducted on pretest and posttest data in both groups. The Shapiro–Wilk Normality Test indicated that the pretest and posttest scores on the Sociological Literacy and Critical Thinking variables in both classes had a normal distribution

($p > 0.05$). Similarly, the results of the Variance Homogeneity Test using Levene's Test confirmed that the pretest and posttest variances between the treatment groups were homogeneous ($p > 0.05$). With all these crucial assumptions being met, ANCOVA's was declared valid and feasible.

Inferential statistical testing of the research hypothesis was conducted using Covariance Analysis (ANCOVA). The use of ANCOVA is essential because it allows researchers to test for significant differences in model effectiveness after statistically controlling for students' initial ability (pretest) as a covariate. This approach was chosen to improve internal validity and address potential bias arising from differences in initial scores and group variances. The ANCOVA results showed that the Learning Model variable had a highly significant effect on both dependent variables: Critical Thinking Ability ($p = 0.001$) and Sociological Literacy ($p = 0.000$). These results statistically demonstrate a significant difference in effectiveness between the Problem-Based Learning Model and Inquiry Learning.

To identify which model is superior, an analysis was conducted on the Adjusted Mean score, the average posttest score neutralized for students' initial ability. The analysis of the Adjusted Mean value definitively confirms the Problem-Based Learning Model as the most effective and influential model. In Critical Thinking Ability, the Adjusted Mean of the PBL group was 104,619, far exceeding the Inquiry Learning group (95.519). Similarly, in Sociology Literacy, the Problem-Based Learning group recorded an Adjusted Mean of 22,414, higher than the Inquiry Learning group (19.586). This consistent advantage shown by the Adjusted Mean, after the influence of initial ability is eliminated, is strong statistical evidence of the superiority of the Problem-Based Learning Model in improving both learning outcome variables. To provide empirical evidence regarding the significance of these findings, a summary of the ANCOVA test results for the Estimated Marginal Means of the two dependent variables is presented in Tables 2 and 3:

Table 2. Estimated marginal means results of critical thinking ability

Estimates				
Dependent Variable: Posttest_CT				
			95% Confidence Interval	
MODEL_PEMB	**Mean**	**Std. Error**	**Lower Bound**	**Upper Bound**
IL	95.519[a]	1.878	91.773	99.266
PBL	104.619[a]	1.878	100.873	108.366

a. Covariates appearing in the model are evaluated at the following values: Pretest_CT = 59.1667.

Table 3. Results of estimated marginal means for sociological literacy

Estimates				
Dependent Variable: Posttest_LS				
			95% Confidence Interval	
MODEL_PEMB	**Mean**	**Std. Error**	**Lower Bound**	**Upper Bound**
IL	19.586[a]	.426	18.736	20.437
PBL	22.414[a]	.426	21.563	23.264

a. Covariates appearing in the model are evaluated at the following values: Pretets_LS = 14.2500.

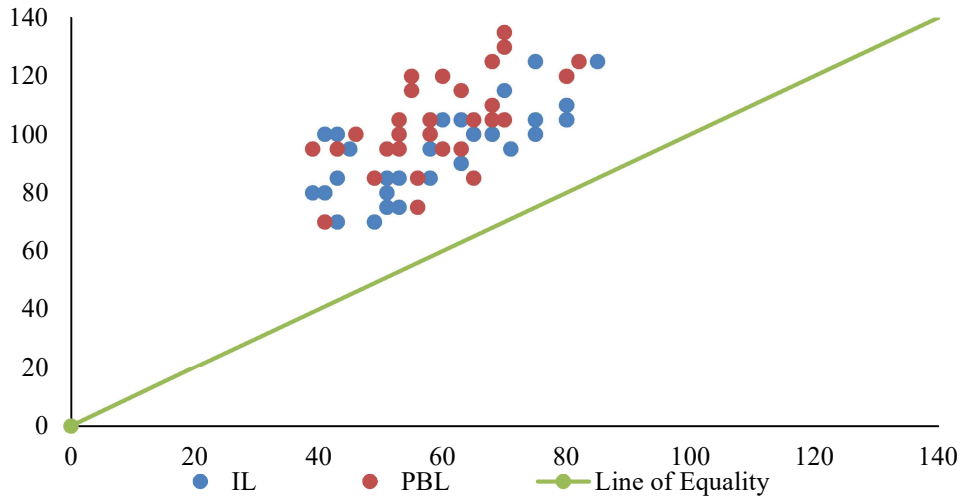

Figure 5. Scatter plot of pretest and posttest scores for critical thinking based on learning models (PBL and inquiry learning)

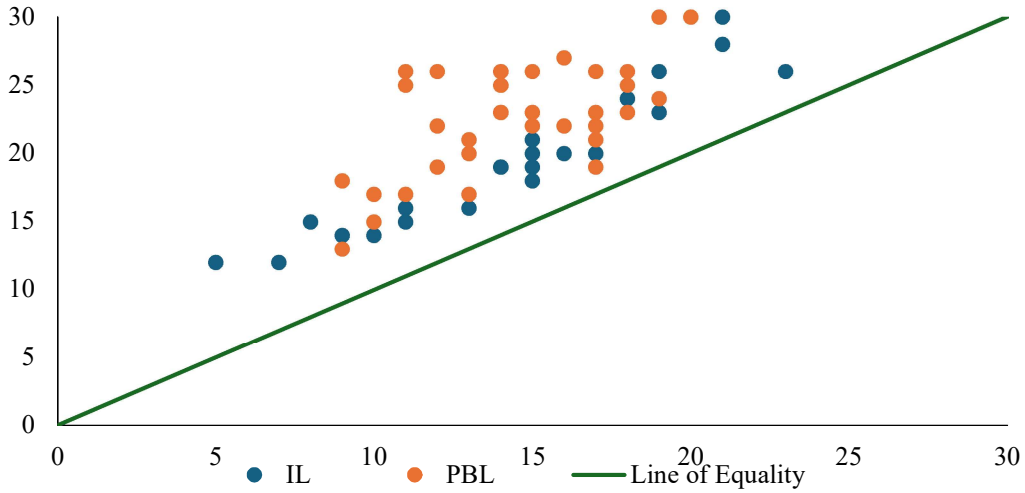

Figure 6. Scatter plot of pretest and posttest scores of sociology literacy based on learning models (PBL and inquiry learning)

The visual analyses in Figures 5 (Critical Thinking) and 6 (Sociological Literacy) provide empirical evidence of the advantages of the PBL Model. Both scatter plots clearly show that the majority of data points from both groups lie above the Line of Equality (y = x), indicating that most students have improved ability. However, the key to the visual findings is the distribution of PBL group data points. Although the scatter plot displays raw values, the data points of the PBL group tend to be concentrated at higher Y positions (Posttest scores) than those of the Inquiry Learning group, especially within the same Pretest (X) score range. This distribution of data visually supports the ANCOVA results: after controlling for the initial ability (Pretest), the PBL model yields a significantly higher Posttest score, as reflected in the superior Adjusted Mean (Tables 2 and 3).

Discussion

The consistent and significant ANCOVA results (p-values of 0.001 and 0.000) are supported by the superior Adjusted Mean, and

the visual analysis in figures 5 and 6 shows that the Problem-Based Learning Model has a clear advantage. This empirical superiority has a solid theoretical and methodological foundation. The definitive advantages of the PBL Model are theoretically explained through the lens of Constructivist Learning Theory and Vygotsky's concept of the Proximal Development Zone (ZPD) (Harland, 2003). The PBL model provides a purposeful scaffolding for authentic problem-solving, facilitating students' construction of their own knowledge through the negotiation of meaning and elaboration. Cognitively, Problem-Based Learning is more effective in training specific sub-skills of Critical Thinking, such as Deciding on an Action, Contextual Analysis, and Making Further Explanations. This sub-skill is at the core of Sociology Literacy, which requires students to connect abstract theories with practical social solutions. The syntax of Problem-Based Learning, especially the phase of analyzing the problem in depth and developing a targeted solution, creates a structured cognitive conflict that forces students to activate schematics and integrate them with new evidence more efficiently than the more open Inquiry Learning Model does.

Support for ANCOVA's findings is strengthened through a multi-method analysis that includes qualitative data and attention to internal validity. First, from the perspective of internal validity, the analysis of observational data shows that teachers implement the PBL Model with greater syntactic consistency (treatment fidelity). This consistency is vital for ensuring that students receive maximum exposure to effective, targeted peer-scaffolding processes, thereby facilitating the achievement of a complex understanding within the Vygotsky ZPD. Second, qualitative analysis of essay data and anonymous answer citations showed that the PBL group consistently integrated sociological theories with social phenomena in a coherent and effective manner. This can be seen in the difference in the quality of reasoning when answering essay questions that require integrating social group theory with the issue of adolescent consumer behavior. Students from the PBL group tend to formulate structured theory-based solutions, as the following quote shows: [P-9 student (PBL)]: "The influence of peer groups on consumption is very strong because it functions as a reference group. Adolescents make peer groups a standard for self-evaluation and a source of social legitimacy. They will imitate consumptive behavior to achieve mechanical solidarity within the group. The solution must focus on internalizing values based on social control through non-formal institutions, not just through economic regulation." In contrast to such reasoning, students from the IL group, whose learning dynamics are more focused on empirical data verification, tend to stop at the description of phenomena without deep integration of sociological theory, such as this example: [I-20 (IL) student]: "Peer group influence is large because they are always together and watch the same social media. They want to be like their friends. For example, if one friend buys a well-known shoe brand, the other will also buy it to avoid ridicule. This makes teenagers extravagant. We have to provide much data on the dangers of debt and unhealthy lifestyles". This comparison of citations corroborates the finding that the PBL model, with its demands for negotiating solutions to complex problems, successfully trains students' reasoning to relate social phenomena to abstract sociological concepts (sociological literacy indicators) and avoid patterns of logical fallacies, which ultimately indicates that structured discussions in PBL successfully train more rigorous and systematic reasoning. The third reinforcement comes from the analysis of the question items in the Sociological Literacy test, which shows that the Problem-Based Learning model excels significantly on concepts that require the application of theory in the formulation of social policies and strategies to overcome inequality, reinforcing that the focus of Problem-

Based Learning on practical solutions is more relevant to the objectives of the sociology curriculum.

The findings of this study are a significant scientific contribution to the sociological pedagogical literature, as they not only strengthen the empirical consistency of international studies but also confirm the superiority of the Problem-Based Learning Model in effectively stimulating high-level and critical thinking skills. The alignment of these findings is comprehensively confirmed by various international and cross-disciplinary studies. A meta-analysis by Argaw et al. (2017) found that Problem-Based Learning has a greater effect on measuring students' critical thinking skills than conventional instructional models. Furthermore, the consistency of these results is further strengthened by the research of Muvid et al. (2022), which specifically demonstrates the superiority of PBL in developing socio-critical thinking skills, a variable closely aligned with the demands of sociological literacy, which focuses on the analysis of social problems. In addition, cross-disciplinary support from the comparative study of Styawan & Arty (2021), which found the superiority of PBL over Inquiry Learning in improving the profile of critical thinking skills in the context of Science (Thermochemistry), validates the robustness of the PBL model as a superior instructional method to stimulate high-level cognition, regardless of the subject matter domain. However, this study makes a more in-depth contribution by demonstrating that the Problem-Based Learning (PBL) Model is far superior at improving learning outcomes, as evidenced by significant adjusted average values (Adjusted Marginal Means) for both bound variables, with initial ability (pretest) controlled as a covariate. This superiority is quantitatively proven: Based on Table 3, the adjusted average Sociology Literacy for the PBL group is 22.414, substantially higher than that of the Inquiry Learning (IL) group, which reached only 19.586. Similarly, the data in Table 2 show that the PBL group's adjusted average Critical Thinking Skills was 104.481, surpassing the IL group's 95.519. This significant difference in adjusted average indicates a strong positive impact of PBL. This shows a superior *fit* between the problem-solving framework for Problem-Based Learning and the demands of Social Science disciplines that involve complex, ambiguous issues. The main implication of these findings is a strong pedagogical recommendation for Sociology teachers to prioritize Problem-Based Learning, in line with the global demands of PISA (OECD, 2023).

CONCLUSION

This study concludes that the Problem-Based Learning Model is statistically superior and significantly more effective than the Inquiry Learning Model in improving students' Sociological Literacy and Critical Thinking Skills, after controlling for initial abilities using Covariance Analysis (ANCOVA). The advantage of PBL is not only a simple average difference, but also a very significant difference in adjusted mean differences (Adjusted Marginal Means) for both outcome variables. For Sociological Literacy, the average PBL (22.414) is substantially higher than the IL (19.586). Similarly, for Critical Thinking Skills, the average PBL (104,481) is much higher than that of IL (95.519). This large adjusted mean difference, once the effect of initial ability is controlled, provides strong evidence of the model's superiority. Conceptually, these findings suggest a superior fit between the directional problem-solving framework in the Problem-Based Learning syntax and the discipline of Sociology's complex, ambiguous issues. The Problem-Based Learning model is successful because it consistently stimulates critical sub-skills essential to social reasoning, such as Deciding an Action and Contextual Analysis, through a structured peer-scaffolding mechanism (ZPD, Vygotsky). At the same time, a high level of implementation

consistency (treatment fidelity) reinforces the internal validity of the results.

The main implication of these findings is a strong pedagogical recommendation: that the Sociology curriculum prioritize Problem-Based Learning as an instructional standard for complex topics that demand the application of social theory in practical solutions. Sociology teachers, for example, are recommended to routinely design authentic problem scenarios that ask students to formulate social policies or strategies to address data-driven inequality, an area of excellence for the Problem-Based Learning group. However, the study had limitations, namely a relatively short intervention period and a limited scope to a single school, which limited the generalizability of the findings to long-term effectiveness and a wider student population. Therefore, the recommendation stemming from the study's limitations is that future research focus on longitudinal studies to measure the effects of long-term retention of Problem-Based Learning on critical thinking skills, and conduct multi-site replications to test the external validity of these findings regarding Problem-Based Learning's superiority.

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