Enhancing Critical Thinking through Model-Based Learning and SDGs in Islamic Studies

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Abstract

Objective: The fundamental purpose of education is to cultivate learners' capacity to think critically as an essential component of human development. Critical thinking aligns with higher-order cognitive processes in Bloom's taxonomy, particularly analyzing, evaluating, and creating, which are central to achieving Sustainable Development Goals (SDGs), especially SDG 4 on quality and inclusive education. This study aims to examine the effect of Model-Based Learning, operationalized through Problem-Based Learning (PBL), on students' critical thinking skills in Islamic Studies at SMP Muhammadiyah 1 Kartasura. **Theoretical framework:** The theoretical framework integrates constructivist learning theory, Bloom's cognitive taxonomy, and the SDGs-oriented education paradigm, emphasizing learner-centered instruction and cognitive empowerment. **Literature review:** Prior studies highlight the effectiveness of PBL in promoting critical reasoning; however, empirical evidence within Islamic education contexts linked explicitly to SDGs remains limited. **Methods:** This research employed an experimental method using a pretest–posttest non-equivalent control group design. The participants consisted of 53 ninth-grade students, with 18 students assigned to the experimental group and 35 students to the control group. Data were collected through structured pre-tests and post-tests designed to measure critical thinking indicators within the cognitive domain of Bloom's taxonomy. **Results:** The findings reveal a statistically significant effect of PBL on students' critical thinking skills in Islamic Studies. The Mann–Whitney test yielded an Asymp. Sig. (2-tailed) value of 0.001, indicating a significant improvement in the experimental group compared to the control group. These results demonstrate that Model-Based Learning contributes meaningfully to developing students' higher-order thinking skills while supporting the goals of sustainable and quality education. **Implications:** The implications of this study suggest that integrating SDGs-oriented PBL into Islamic education can enhance cognitive competence, foster critical awareness, and prepare students for complex social challenges. **Novelty:** The novelty of this research lies in its empirical linkage between Model-Based Learning, Islamic Studies, and SDGs within a junior high school context, offering a replicable framework for sustainable educational practices.

Keywords: model-based learning, problem-based learning, critical thinking, islamic education, sdgs-oriented education.

INTRODUCTION

In recent years, the development of students' critical thinking skills has become a central concern in global educational discourse, particularly in relation to the Sustainable Development Goals (SDGs). SDG 4 emphasizes the provision of inclusive, equitable, and quality education that promotes lifelong learning opportunities and higher-order cognitive skills. Critical thinking, as conceptualized in Bloom's taxonomy—encompassing analyzing, evaluating, and creating—has been widely recognized as a core competency for achieving sustainable human development. Despite this global emphasis, the practical integration of critical thinking-oriented pedagogy within subject-specific and faith-based education remains uneven [1].

Model-Based Learning, particularly Problem-Based Learning (PBL), has been extensively studied in science, mathematics, and general education contexts, where it is shown to enhance students' analytical and evaluative abilities. Previous studies consistently report that PBL encourages active learning, collaborative problem solving, and reflective thinking. However, much of this literature is situated in secular or STEM-oriented learning environments, with limited attention to religious education, especially Islamic Studies at the secondary school level. This indicates a conceptual and empirical gap between global pedagogical innovations and their application within Islamic education systems [2].

Moreover, existing research on Islamic education often prioritizes moral formation, religious literacy, and affective outcomes, while cognitive dimensions—particularly critical thinking—are comparatively underexplored. When critical thinking is addressed, it is frequently discussed normatively or theoretically rather than examined through empirical and experimental methods. This gap is further widened by the limited alignment of Islamic education research with the SDGs framework, despite the shared emphasis on human dignity, ethical responsibility, and social sustainability [3].

In the Indonesian context, Islamic education plays a strategic role in shaping students' intellectual and moral capacities. Nevertheless, classroom practices in Islamic Studies are still predominantly teacher-centered, focusing on content transmission rather than cognitive engagement. Empirical evidence assessing the effectiveness of Model-Based Learning in fostering critical thinking within Islamic Studies, particularly at the junior high school level, remains scarce. Few studies have employed rigorous experimental designs to measure cognitive gains using standardized frameworks such as Bloom's taxonomy while simultaneously situating their findings within the SDGs agenda [3].

Therefore, this study addresses a critical research gap by empirically examining the impact of Model-Based Learning through a Problem-Based Learning approach on students' critical thinking skills in Islamic Studies, explicitly framed within the SDGs perspective. By integrating constructivist pedagogy, cognitive theory, and sustainable education goals, this research contributes a novel, context-sensitive model for advancing quality education in faith-based learning environments. The essence of an education is to develop thinking skills. Thinking becomes a very vital part or object that needs to be possessed by every element of Education [4].

The ability to think is very important in the world of education, so through this education, a person can develop thinking skills. It is explained in another reference

that the purpose of education in schooling is to improve the ability to think critically and make rational decisions about what to do or what to believe. This explanation gives a signal that the process of obtaining knowledge requires the ability to think critically, which is then needed in determining rational decisions about what to do and what to believe [4].

Thinking is the main characteristic of humans, Allah glorifies humans because they have a reason, and this is what distinguishes humans from animals, that's why humans are categorized as *al-insan hayawan nathiq*, which is an animal creature that can see natural phenomena. This means that by thinking, humans can jump to everything and problems that can be solved. Humans can think of abstract meanings, for example, about good, bad, virtue, humiliation, truth, and falsehood. It's just that the human potential to think with reason in perception and knowledge is little. The reason is that humans, as thinking creatures who become nature, cannot develop directly if empowered. Alwashilah explained that the ability to think can be carried out externally (conditioned creation) or internally (self-awareness) so that, slowly, you will have the ability to think critically [5], [6].

Critical thinking has an important role in developing potential, doing assignments, and finding solutions to problems encountered, as well as being able to conclude the material that has been taught during the learning process [7]. However, many students do not participate in the teaching and learning activity process (KBM) well, so when asked to conclude the material that has been studied, they repeat a few sentences about the material and cannot conclude. In addition, when students are given practice questions related to the subject matter, many cannot do these questions. These learning activities prove that there are obstacles in learning that result in low critical-thinking students [8]. This critical thinking ability is not only formed through general education learning but also through Islamic Religious Education [9], [10].

Islamic Religious Education has a very important role in carrying out daily life. This education serves to shape and guide the character of students to become devout, noble character, and tolerant of each other [11]. In the implementation of Islamic education, teachers have a very important role in shaping students' critical thinking skills. Teachers need to provide stimulus, facilitate discussions, and encourage students to think critically [12]. Through directed and inspiring teaching, teachers can help students understand the relationship between religious teachings and real-world contexts so that students can develop critical and reflective thinking. In addition, the Islamic education curriculum also needs to be designed in such a way that it can integrate critical thinking learning with the principles of Islamic teachings so that it can develop a critical attitude that is in line with religious values [13], [14].

However, the implementation of critical thinking in PAI learning is still not optimal. This is evidenced by the results of pre-observation at SMP Muhammadiyah 1 Kartasura related to the learning process of PAI, and it was found that students still find it difficult to think critically in terms of expressing opinions, solving problems and answering HOTS questions [15]. This is because students' literacy skills are still minimal, learning motivation in students is still low, cognitive abilities between students are different from each other, and learning methods or learning strategies implemented by educators are still teacher-centered (*teacher center*), resulting in a lack of activities that stimulate students' critical thinking skills [16], [17].

Critical thinking skills are relevant to the concept of thinking domains or cognitive domains of Bloom's taxonomy that have been revised by Anderson and Krathwohl, which are found in C4 (analyzing), C5 (evaluating), and C6 (creating). The ability of each individual can be developed in analyzing ideas and ideas by practicing thinking skills [18]. Efforts to produce quality human resources are by getting used to forming a culture of critical thinking in the learning process [19]. One of the strategies that can be used to empower critical thinking is to use *the Problem-Based Learning* (PBL) model [20]. Previous studies have shown that PBL is effective in improving learning outcomes, problem-solving [21], creative thinking, and critical thinking [22].

Departing from this problem, the researcher wishes to research with the title "The Influence of the Problem-Based Learning (PBL) Model on PAI Learning on Students' Critical Reasoning in the Cognitive Domain of Bloom's Taxonomy at SMP Muhammadiyah 1 Kartasura (Critical Reflection in Islamic Teachings) Academic Year 2024/2025" which is expected to be able to provide scientific insights related to this theme.

LITERATURE REVIEW

Critical thinking has long been recognized as a fundamental objective of education, particularly in preparing learners to engage with complex problems and make reasoned decisions. Within the framework of Bloom's taxonomy, critical thinking is situated in the higher-order cognitive domain, encompassing the abilities to analyze, evaluate, and create. These competencies are essential for fostering independent learners who can adapt to dynamic social and intellectual challenges. In the context of sustainable development, critical thinking is closely aligned with the goals of quality education, as it enables individuals to contribute meaningfully to social, economic, and ethical development. Model-Based Learning has emerged as a pedagogical approach that emphasizes active student engagement through structured inquiry, problem solving, and reflection. By positioning learners as active constructors of knowledge, this approach supports deeper cognitive processing and conceptual understanding. Problem-Based Learning, as a form of Model-Based Learning, places real-world problems at the center of instruction, encouraging students to identify issues, generate hypotheses, and evaluate possible solutions. This process inherently stimulates critical thinking by requiring learners to move beyond memorization toward analytical and evaluative reasoning [23].

Previous studies consistently indicate that Problem-Based Learning enhances students' critical thinking skills across various educational settings. Through collaborative discussion and problem exploration, students develop the ability to articulate arguments, assess evidence, and reflect on alternative perspectives. These outcomes suggest that Model-Based Learning provides a conducive environment for cultivating higher-order cognitive skills. However, the effectiveness of this approach is influenced by contextual factors such as subject matter, instructional design, and learner characteristics. In religious education, particularly Islamic Studies, learning objectives have traditionally emphasized moral development, spiritual awareness, and religious understanding. While these goals are essential, there is increasing recognition that Islamic education must also engage cognitive dimensions to remain relevant in contemporary society. Integrating critical thinking within Islamic Studies allows learners to engage more deeply with religious texts, ethical issues, and social realities, fostering a balanced development of intellect and character [24].

Despite its potential, the application of Model-Based Learning in Islamic education remains limited. Many instructional practices continue to rely on teacher-centered methods that prioritize content delivery over inquiry-based learning. Furthermore, the alignment between innovative pedagogical approaches and the Sustainable Development Goals has

not been systematically explored within Islamic education contexts. This literature highlights the need for empirical studies that examine how Model-Based Learning can enhance critical thinking in Islamic Studies while supporting the broader agenda of sustainable and quality education [25].

METHODOLOGY

This study employed a quantitative research paradigm to examine the effectiveness of instructional innovation in enhancing students' critical thinking skills within the framework of Sustainable Development Goals (SDGs), particularly SDG 4, which emphasizes quality, inclusive, and equitable education. Quantitative research was selected because it enables objective measurement, statistical testing, and systematic evaluation of learning outcomes, all of which are essential for assessing educational practices that contribute to sustainable human development. The research adopted an experimental approach using a pretest–posttest non-equivalent control group design. This design involved two groups—an experimental group and a control group—both of which were assessed before and after the instructional intervention. The experimental group received instruction using Model-Based Learning implemented through a Problem-Based Learning approach designed to promote higher-order cognitive skills relevant to sustainable education. In contrast, the control group was taught using conventional teacher-centered methods. Pretests were administered to assess students' initial critical thinking abilities, while posttests measured cognitive development after the intervention [26].

The participants in this study were ninth-grade students at SMP Muhammadiyah 1 Kartasura. Class 9 IT served as the experimental group, while Class 9 Creative functioned as the control group. The use of intact classes was necessitated by institutional constraints, making this study a quasi-experimental design. This approach reflects real classroom conditions and supports the practical relevance of the findings for achieving SDGs-oriented educational improvement. Data collection techniques included observation, testing, and documentation. Observations were conducted to ensure fidelity in the implementation of Model-Based Learning and to monitor student engagement during problem-solving activities aligned with SDGs principles, such as critical inquiry and collaborative learning. Testing was conducted through structured pretests and posttests to measure students' critical thinking skills in the cognitive domain of Bloom's taxonomy, focusing on analytical, evaluative, and creative thinking. Documentation supported the collection of instructional records and learning materials [27].

The research instruments consisted of Learning Implementation Sheets, student worksheets, teaching modules, and pretest–posttest questions. Instrument validity was established through expert judgment using the Gregory index validation method to ensure alignment with critical thinking indicators and SDGs-based learning objectives. Reliability testing was conducted to confirm measurement consistency. Data analysis involved descriptive statistics to summarize students' learning outcomes and inferential statistics using the Wilcoxon test and the Mann–Whitney test. These analyses were used to determine the significance of the Model-Based Learning intervention in fostering critical thinking skills as a key indicator of quality education within the SDGs framework [27].

RESULTS AND DISCUSSION

This study aims to determine the effect of the based learning model on improving students' critical reasoning in Islamic Religious Education learning. The study was conducted in 4 meetings in the experimental class and the control class. Before being given treatment, students in both classes worked on pretest questions to determine their initial

critical thinking skills, after the pretest was conducted, data was obtained that students got scores below the KKM, which was 85. The results of the pretest learning of students in the experimental and control classes can be seen in the following diagram.
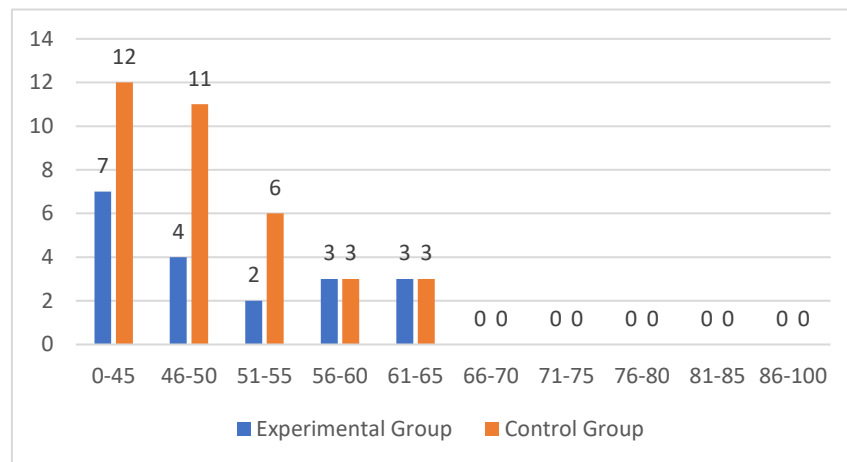

Figure 1. Pre-Test Frequency Distribution the Experimental Group and the Control Group

The diagram above shows that the pretest results of the control and experimental classes in Islamic Religious Education learning have low or incomplete results based on the established KKM, namely 85. The pretest results of the two classes only obtained the highest score of 63.

Meanwhile, after being given treatment in the experimental class for 3 meetings, it showed increased learning outcomes in the class. The results can be seen in the following diagram.
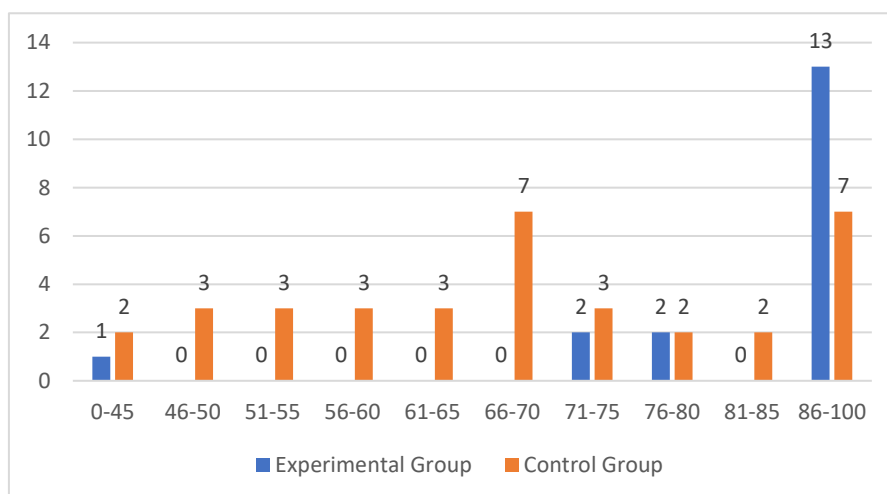

Figure 2. Post-Test Frequency Distribution the Experimental Group and the Control Group

The diagram above shows a very significant difference after the researcher gave treatment in the experimental class so that it obtained the highest score of 93 and as many as 13 students completed with a score above the KKM. In the control class, there was indeed an increase but it was not as significant as the experimental class, in the control class, there were 7 children who completed with the highest score of 90 and 28 children who did not complete or were below the KKM that had been set. The research results data can be seen in the table below:

Table 1. Data Pre-Test Scores of the Experimental Group and the Control Group

Group	Highest Score	Lowest Score	Completed Students	Percentage of completion	Average	Standard Deviation
Experiment	63	27	0	0%	47,94	10,575
Control	63	30	0	0%	46,69	8,844

Table 2. Data Post-Test Scores of the Experimental Group and the Control Group

Group	Highest Score	Lowest Score	Completed Students	Percentage of completion	Average	Standard Deviation
Experiment	93	43	13	72,22%	82,89	12,024
Control	90	35	7	20%	68,46	14,807

Based on Table 1 and Table 2, data on students critical thinking skills can be interpreted through the following diagram.
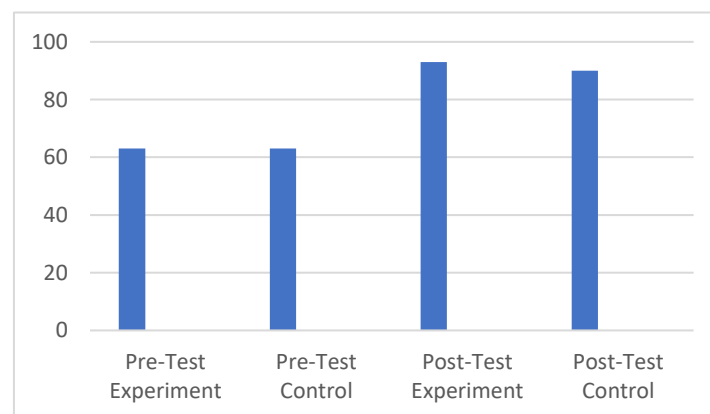

Figure 3. Comparison Diagram of Critical Thinking Abilities of Student in the Experiment an Control Group

Based on the table above, there are differences in the results of the pre-test and post-test of the experimental class and the control class. Where the experimental class treated with the PBL method experienced significant changes compared to the control class with the conventional method [28].

To complete the hypothesis test, the following analyses were carried out: (1) The Wilxocon test was carried out to find out whether there was an average difference between the two paired samples [29]. The research data used in the Wilxocon test is abnormally distributed data. The Wilxocon test, called *wilxocon signed rank* is a non-parametric statistical method. and (2) Mann-Whitney Test The Mann-Whitney test aims to find out whether there is an average difference between two free samples. The Mann-Whitney test is used as an alternative to the independent *t-test*, i.e., the research data is not normally distributed and is not homogeneous [30], [31].

Table 3. Wilxocon Test Statistical Results

	Post Test Eksperimen - Pre-Test Eksperimen	Post Test Kontrol - Pre-Test Kontrol
Z	-3.731[b]	-4.926[b]
Asymp. Sig. (2-tailed)	,000	,000

Based on the table above, it can be seen that the value of *Asymp.Sig. (2-tailed)* in the experimental class is 0.000 < 0.05, then the hypothesis is accepted, which means that there is an average difference between two paired samples. While the value of *Asymp.Sig. (2-tailed)* in the control class is 0.000 < 0.05, then the hypothesis is accepted, which means that there is an average difference between two paired samples [32].

Table 4. Statistical Test Results of the Mann-Whitney Test

Test Statistics

	Nalar Kritis Siswa
Mann-Whitney U	136,500
Wilcoxon W	766,500
Z	-3,378
Asymp. Sig. (2-tailed)	,001

a. Grouping Variable: Kelas

Based on the table above, it can be seen that the value of Asymp.Sig. (2-tailed) of 0.001, so it can be concluded that 0.001 < 0.050, then the hypothesis is accepted. If the hypothesis is accepted, it means that there is a significant influence of the use of the PBL model on PAI learning on students' critical reasoning in the cognitive realm of Bloom's taxonomy at SMP Muhammadiyah 1 Kartasura.

Based on the data from the research and data analysis, it can be seen that PBL as a learning model is proven to improve student's critical reasoning through the study of solving a problem in the material [33]. Gratitude with Akikah, caring for others by sacrificing This can be seen from the increase in the pre-test and post-test scores of the experimental class. Thus, there is a difference in critical reasoning ability between the experimental class taught with the PBL model and the control class that does not use the PBL model [34]. The critical reasoning ability of the experimental class was higher than that of the control class. Supported by the data of pre-test and post-test results in the two classes, the experimental class using the PBL model got a higher average score of 82.89, while the control class got an average score of 68.46. This is reinforced by research from Yayah Tazkiyah Nana Suryapermana and Anna Primadoniati [35], who stated that the learning outcomes of the experimental group that received higher treatment compared to the control group that did not receive treatment [36], [37]. In addition, it can be concluded that the Problem-Based Learning (PBL) model can improve students' critical reasoning skills. Strengthened by research from Retnaning Tyas [38], Alimul Muniroh [39], and Elfa Eriyani et al [40], which stated that the PBL model is a learning model by presenting a problem that aims to stimulate students' critical thinking skills in finding solutions in solving the problems presented.

Analysis

The findings of this study demonstrate that Model-Based Learning implemented through Problem-Based Learning (PBL) has a substantial impact on enhancing students' critical reasoning skills in Islamic Religious Education. The marked difference between the

experimental and control groups indicates that instructional design plays a decisive role in shaping higher-order cognitive development. While both groups showed improvement from pre-test to post-test, the magnitude of cognitive gain in the experimental group was significantly greater, suggesting that PBL provides learning conditions that more effectively stimulate analytical, evaluative, and creative thinking as conceptualized in Bloom's taxonomy [36], [37].

The relatively similar pre-test scores of both groups indicate that students began with comparable baseline levels of critical reasoning. This strengthens the internal validity of the findings, as the post-test differences can be attributed primarily to the instructional intervention rather than initial cognitive disparities. The substantial increase in the experimental group's post-test average reflects the effectiveness of PBL in engaging students actively with learning content through problem identification, collaborative discussion, and solution-oriented inquiry. These processes require students to interpret information, justify reasoning, and reflect on alternative perspectives, all of which are core elements of critical thinking. In contrast, the control group's moderate improvement suggests that conventional instruction can facilitate cognitive growth to some extent but is limited in its capacity to foster deeper reasoning. Teacher-centered approaches tend to emphasize information transmission and recall, which may support lower-order cognitive skills but provide fewer opportunities for students to engage in sustained inquiry and reflective judgment. This difference highlights the pedagogical shift required to move from content-oriented learning toward cognition-oriented learning, particularly in Islamic education contexts [40].

From a theoretical perspective, the results support constructivist learning principles, which posit that knowledge is actively constructed through interaction and problem solving. PBL aligns with this view by positioning students as active participants rather than passive recipients of information. In Islamic Studies, this approach enables learners to engage critically with religious concepts, ethical dilemmas, and real-life applications of Islamic teachings, thereby integrating cognitive development with moral and spiritual reflection. Within the framework of the Sustainable Development Goals, particularly SDG 4, the findings underscore the importance of learner-centered pedagogy in achieving quality and equitable education. Critical thinking is a key competency for sustainable development, as it equips learners with the ability to navigate complexity, make informed decisions, and respond responsibly to societal challenges. By demonstrating the effectiveness of PBL in Islamic education, this study contributes empirical evidence that faith-based education can actively support global educational agendas without compromising its normative values. The analysis suggests that integrating PBL into Islamic education offers a viable pathway toward sustainable, cognitively enriching, and contextually relevant learning practices [40].

CONCLUSION

Based on the results of the research and discussion, this study concludes that the implementation of Problem-Based Learning (PBL) has a significant and positive effect on students' critical reasoning skills in Islamic Education (PAI) at SMP Muhammadiyah 1 Kartasura. In the control group, consisting of 35 ninth-grade Creative students who were taught using conventional instructional methods, the average pre-test score of critical reasoning was 46.69, which increased to 68.46 in the post-test. This improvement indicates that learning activities, even without PBL, contribute to cognitive development; however, the magnitude of improvement remains moderate. In contrast, the experimental group comprising 18 ninth-grade IT students who received instruction through the PBL model demonstrated a substantially higher improvement. The average pre-test score in this group was 47.94, which increased markedly to 82.89 in the post-test. This finding confirms that PBL is more effective in fostering higher-order cognitive skills, particularly critical reasoning within the cognitive domain of Bloom's taxonomy, including analysis,

evaluation, and creation. Statistical analysis further supports these findings. The data were found to be non-normally distributed; therefore, non-parametric tests were applied. The Wilcoxon test revealed significant differences between pre-test and post-test scores in both the experimental and control groups, with Asymp. Sig values of 0.000, indicating meaningful learning gains in each group. However, the Mann–Whitney test demonstrated a significant difference between the two groups, with an Asymp. Sig. (2-tailed) value of 0.001, confirming that the use of the PBL model resulted in significantly higher critical reasoning outcomes compared to conventional instruction. From the perspective of the Sustainable Development Goals, particularly SDG 4 on quality education, these findings highlight the strategic role of learner-centered and inquiry-based pedagogies in promoting inclusive and effective learning environments. By enhancing students' critical thinking skills, PBL contributes to the development of competencies necessary for lifelong learning, ethical reasoning, and social responsibility. Therefore, integrating PBL into Islamic education not only strengthens cognitive achievement but also supports sustainable educational practices aligned with global development goals.

Acknowledgments

Author Contribution

Elyana Nur Sholikhah conceptualized the study, conducted data collection, and drafted the manuscript. Waston contributed to theoretical framing, SDGs integration, and critical revision. Mahasri Shobahiya assisted with data analysis and interpretation. Kani Ulger provided methodological guidance and international academic perspectives. All authors reviewed and approved the final manuscript.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript. The research was conducted independently without any financial, institutional, or personal relationships that could have influenced the study's design, data collection, analysis, interpretation, or reporting of the results.

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