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The Effect of Student Ability-Based Learning Approach on Fourth Grade Students' Critical Thinking Skills

Ayuni Fitria[1*], Nurdinah Hanifah[2], Dety Amelia Karlina[3]
[1-2]Universitas Pendidikan Indonesia

**Corresponding author : ayunifitria03@upi.edu*

Abstract

The development of critical thinking skills in elementary science (IPAS) instruction is frequently hindered by rigid, uniform teaching methods that fail to accommodate diverse learner readiness, particularly within the highly heterogeneous classrooms of Madrasah Ibtidaiyah. This study aims to evaluate the effectiveness of the Student Ability-Based Learning (SABL) approach in enhancing the critical thinking skills of fourth-grade students. Using a pre-experimental method with a one-group pretest-posttest design, the study involved a total sampling of 33 fourth-grade students at MI Al-Hadi, Sukabumi Regency. Data were collected via validated reasoned complex multiple-choice tests, and analysed using the non-parametric Wilcoxon Signed-Rank Test alongside N-Gain and effect size calculations. The results revealed a significant improvement in students' critical thinking skills ($p < 0.001$), with the average score increasing from 55.97 on the pretest to 81.21 on the posttest. Furthermore, the analysis yielded a moderate N-Gain score of 0.57 and a large effect size of 0.87, indicating a powerful intervention impact. This study concludes that the SABL approach effectively fosters critical thinking skills by operationalizing a systematic, data-driven instructional cycle consisting of diagnostic assessment, flexible ability grouping, tiered worksheets, and adaptive scaffolding. This structured framework offers a targeted and highly practical pedagogical model to overcome student background disparities, cultivate higher-order cognitive capacities, and promote educational equity in Islamic primary classrooms.

Keywords *: Student Ability-Based Learning, critical thinking, differentiated instruction, IPAS Learning, Madrasah Ibtidaiyah.*

INTRODUCTION

Critical thinking skills are a major issue in primary education that has not been optimally resolved. In daily learning practices, many students are still trapped in memorizing information rather than analysing, evaluating, or solving problems logically and systematically based on facts and data (Anggraeni et al., 2022). In the educational context, critical thinking skills play an important role in helping students understand problems deeply and make rational decisions. This low critical thinking literacy hinders students from objectively determining appropriate solutions to real-world problems in

their daily lives (Fitria Ningsih & Oktaviari, 2025). Ideally, foundations of logic, reasoning, and problem-solving should be built from the elementary school level through contextual and interactive learning, enabling students to construct knowledge independently through meaningful learning experiences (Rahmawati et al., 2025).

However, developing students' critical thinking skills in elementary schools faces major challenges due to the persistent use of a one-size-fits-all approach. Teachers frequently deliver the same materials and methods to all students without considering differences in prior abilities, learning readiness, and individual characteristics (Goyibova et al., 2025). This practice creates a stark disparity in the classroom; students with lower abilities experience learning anxiety because the cognitive burden is too high, while students with higher abilities feel unchallenged, leading to a decrease in learning motivation. In reality, elementary school students possess diverse cognitive styles, information-processing speeds, and levels of learning readiness (Rahmah et al., 2025). Failure to accommodate these differences hinders the optimal development of students' critical thinking potential. Therefore, adaptive and inclusive learning approaches are urgently needed to ensure every student receives instructions that match their cognitive needs.

In the context of Madrasah Ibtidaiyah, learning must be oriented toward developing reflective thinking, problem-solving, and holistic character. To create an inclusive environment, teachers must consider students' prior ability (initial ability). Wardah et al., (2025) argue that prior ability has a significant relationship with learning success because students' existing knowledge serves as the foundation for understanding new information. Fauziah & Fitria (2022) add that mapping students' prior abilities helps teachers determine instructional strategies that align with students' needs. Learning that ignores prior abilities may create a less inclusive learning environment because students who need additional assistance do not receive appropriate support, while students with higher abilities do not obtain sufficient challenges to develop their critical thinking skills optimally.

To address these issues, the Student Ability-Based Learning (SABL) approach emerges as an adaptive instructional model that places students' prior abilities as the basis for planning and implementation. Grounded in social constructivist theory, SABL emphasizes providing learning support (scaffolding) according to students' specific needs and developmental stages (Prasasty et al., 2025). Through data-driven diagnostic assessments, flexible grouping, and tiered assignments, SABL ensures that higher-ability students receive tasks that stimulate Higher Order Thinking Skills (HOTS), while

basic-ability students receive intensive guidance (Fauziah & Fitria, 2022; Jihan et al., 2023). Previous studies have shown that adjusting instruction to students' capacities significantly increases active participation, motivation (Endang Lestari et al., 2024), self-efficacy, and learning outcomes (Comedia et al., 2025).

This condition was also found in fourth-grade IPAS (Ilmu Pengetahuan Alam dan Sosial) learning at MI Al-Hadi. Based on preliminary observations conducted in class IV MI Al-Hadi, students' critical thinking skills in IPAS learning were still relatively low. Students experienced difficulties in analyzing information, identifying cause-and-effect relationships, and drawing conclusions during learning activities. In addition, students' learning outcomes were still below the Minimum Mastery Criteria (KKM). Some students were able to provide logical reasoning, while others still experienced difficulties in connecting obtained information with the concepts being learned. The selection of IPAS as the subject of this study is driven by its characteristics as an integrated subject that combines scientific and social inquiry. IPAS requires students not only to understand concepts but also to analyze phenomena, evaluate information, and solve contextual problems. These competencies are closely related to critical thinking skills. Therefore, adaptive learning approaches that accommodate students' diverse abilities are needed to support meaningful learning in IPAS.

To understand the current state of literature, it is essential to map existing research related to prior ability, critical thinking skills, and adaptive learning. Studies by Rahmah et al., (2025); Salam & Irwan, (2025); and Wardah et al., (2025) consistently indicated that students' prior ability significantly influences learning success and conceptual understanding. These studies emphasized that prior knowledge serves as the foundation for acquiring new information; however, they mainly examined prior ability as a predictor of learning outcomes rather than as a basis for instructional intervention.

Research focusing on critical thinking skills has also demonstrated the importance of student-centred learning. Anggraeni et al., (2022); Fauziah & Fitria, (2022); and Rahmawati et al., (2025) reported that contextual and differentiated learning experiences contribute positively to students' analytical and reasoning abilities. In addition, studies by Comedia et al., (2025); Endang Lestari et al., (2024); Jihan et al., (2023); and Prasasty et al., (2025) highlighted the potential of adaptive learning approaches, including Student Ability-Based Learning (SABL), in improving student engagement, motivation, self-efficacy, and academic achievement. Nevertheless, these studies primarily focused on learning outcomes, participation, or motivation, while empirical investigations examining the direct effect of SABL on critical thinking skills

remained limited.

Despite these valuable contributions, several important research gaps remain. First, most studies have examined prior ability merely as a statistical predictor of general cognitive learning outcomes rather than utilizing it as an operational baseline for classroom intervention. Second, quantitative empirical evidence regarding the direct effect of the SABL approach on students' critical thinking skills remains limited, as prior research predominantly measured general achievement, learning motivation, or classroom participation. Third, research investigating the implementation of SABL within IPAS learning at the elementary school level—particularly within the distinctive context of Madrasah Ibtidaiyah—is still scarce. Accordingly, this study aims to address these gaps by empirically examining the effect of the Student Ability-Based Learning (SABL) approach on critical thinking skills of fourth-grade students in IPAS learning at MI Al-Hadi. The study is novel in that integration of the SABL approach with the development of critical thinking skills in integrated science and social studies (IPAS) at the Madrasah Ibtidaiyah level, an area that has received limited attention in previous studies, which have primarily focused on general academic achievement and learning motivation. Furthermore, this study offers three main contributions. First, it provides quantitative evidence of the effectiveness of the SABL approach in improving critical thinking skills as the primary dependent variable. Second, it operationalizes diagnostic assessment and tiered assignments as a structured framework for personalized learning in Islamic primary education. Third, it offers practical insights for teachers in designing adaptive instruction that accommodates student diversity while promoting higher-order thinking skills.

METHODS

This study employed a quantitative approach using a pre-experimental method with a one-group pretest-posttest design (Fitalia Utama et al., 2024). This design was used to identify changes in students' critical thinking skills before and after the implementation of the Student Ability-Based Learning (SABL) approach. The one-group design was intentionally selected due to the specific institutional context at MI Al-Hadi, which features only a single, non-parallel fourth-grade class. Consequently, establishing a separate, homogeneous control group within the same school environment was unfeasible. To mitigate threats to internal validity and control for potential bias inherent in single-group designs, the researchers implemented a rigorous, intensive five-meeting intervention framework. This process was tightly controlled through continuous diagnostic assessments and structured, tiered scaffolding tailored strictly to individual

student readiness levels. The research subjects consisted of all 33 fourth-grade students at MI Al-Hadi. Total sampling was applied because the entire population was used as the research sample. The study was conducted during the second semester of 2025/2026 academic year at MI Al-Hadi, Sukabumi Regency. The implementation of the Student Ability-Based Learning (SABL) approach was conducted in five learning meetings. At the beginning of the study, students completed a diagnostic assessment through a pretest to identify their prior abilities in critical thinking skills. Based on the results, students were grouped into high, medium, and low readiness levels. Students with high readiness levels were given more complex analytical tasks, while students with lower readiness levels received more structured guidance and scaffolding through tiered worksheets (LKPD berjenjang). The scaffolding process was carried out gradually through teacher assistance, guiding questions, and simplified learning activities adjusted to students' readiness levels.

Data collection techniques included pretests and posttests to measure students' critical thinking skills. The research instrument consisted of reasoned complex multiple-choice questions developed based on indicators of critical thinking skills adapted from Anggraeni et al., (2022), including: (1) identifying problems, (2) analysing information, (3) determining cause-and-effect relationships, (4) providing logical reasons, and (5) drawing conclusions. Complex multiple-choice items were chosen over traditional essays because they effectively measure students' analytical and information-discrimination abilities while significantly reducing the guessing effect common in standard multiple-choice tests. Furthermore, for fourth-grade Madrasah Ibtidaiyah students, this format accurately captures higher-order thinking skills without confounding the results with individual language barriers or writing anxiety often encountered when constructing lengthy essay responses.

Initially, a total of 20 items were drafted to comprehensively cover the five main indicators of critical thinking. Prior to implementation, the instrument was validated through expert judgment involving two validators, namely one elementary school teacher and one university lecturer in elementary education. The validation process evaluated the relevance of the items to the indicators of critical thinking skills, clarity of language, and suitability of the questions with the learning objectives. Based on the validation results, five items were declared invalid and removed, while several other items were revised according to the validators' suggestions. After revision, a reliability test was conducted on the remaining 15 items using Cronbach's Alpha. The analysis showed a reliability coefficient of 0.781, which indicates a high level of reliability.

Therefore, the instrument was considered appropriate and consistent for measuring students' critical thinking skills. Furthermore, this study acknowledges certain methodological limitations. First, the investigation was restricted to a single class with a relatively small sample size (n = 33), which limits the immediate generalizability of the findings to broader or more diverse educational contexts. Second, the absence of a parallel control group means that external historical or maturation factors could not be entirely isolated. However, these limitations were carefully counterbalanced by ensuring high fidelity in the implementation of the SABL steps and maintaining consistent teacher-guided scaffolding throughout the short-term intervention period. The collected data were analysed using descriptive statistics, the Shapiro–Wilk normality test, the Wilcoxon Signed Rank Test, N-Gain analysis, and Effect Size analysis. The Wilcoxon Signed Rank Test was selected as the non-parametric statistical alternative for hypothesis testing because the pretest data did not meet the normality assumption. The N-Gain analysis was employed to determine the level of improvement in students' critical thinking skills, while Effect Size analysis was used to measure the magnitude of the treatment effect after the implementation of the SABL approach. N-Gain was calculated using the following formula : N – Gain = (Skor Post test – Skor Pre test)/(Skor Max – Skor Pre test). The classification of N-Gain levels according to Hake (as cited in Wahab et al., 2021) is presented in table 1.

Table 1. N-Gain Criteria

Average Score	Criteria
$g > 0,7$	High
$0,3 \leq g \leq 0,7$	Moderate
$0 < g < 0,3$	Low
$g \leq 0$	Failed

Effect size analysis was conducted to determine the magnitude of the effect of the Student Ability-Based Learning (SABL) approach on improving students' critical thinking skills. Since the data were not normally distributed and the hypothesis testing used the nonparametric Wilcoxon Signed Rank Test, the effect size was calculated using the Rosenthal formula as follows : $r = Z/(\sqrt{n})$

RESULTS AND DISCUSSION

Results

This study investigates the effect of Student Ability-Based Learning (SABL) approach on the critical thinking skills of fourth-grade students in IPAS learning. The

research data were obtained from pretest and posttest results administered before and after the implementation of the SABL approach. Based on the results of descriptive statistical analysis, the students' average pretest score of 55.97 increased to 81.21 on the posttest. In addition, the minimum student score increased from 43 to 60, while the maximum score increased from 86 to 100. These increases indicate a positive change in students' critical thinking skills following the implementation of the SABL approach. The statistical descriptions of the pretest and posttest scores are presented in table 2.

Table 2. Statistical Description of Pretest and Posttest

Data	Minimum Score	Max Score	Average	Median	Std. Deviation
Pretest	43	86	55.97	53.00	10.340
Posttest	60	100	81.21	83.00	10.043

These findings indicate a positive improvement in students' critical thinking skills after the implementation of Student Ability-Based Learning approach. Before testing the hypotheses, the data were first tested for normality using the Shapiro-Wilk test because the sample size was less than 50 students. The results of the normality test showed that the pretest data were not normally distributed with a significance value of <0.001, while the posttest data were normally distributed with a significance value of 0.116. Therefore, hypothesis testing was continued using the nonparametric Wilcoxon Signed Rank Test. The results of the normality test are presented in table 3.

Table 3. Results of the Normality Test

Data	Statistic	df	Sig	Description
Pretest	0.784	33	<0.001	Not Normal
Posttest	0.948	33	0.116	Normal

The results of the Wilcoxon Signed-Rank Test showed a p-value of <0.001. This value indicates that there is a significant difference between students' pretest and posttest scores following the implementation of the SABL approach. Thus, the Student Ability-Based Learning approach has an effect on students' critical thinking skills in IPAS instruction. The results of the Wilcoxon test are presented in table 4.

Table 4. Results of the Wilcoxon

Test Statistic	Value
Z	-5.018
Asymp. Sig. (2-tailed)	< 0.001

To determine the extent of improvement in students' critical thinking skills, N-Gain and effect size analyses were conducted. The analysis showed an average N-Gain value of 0.57, which falls into the moderate category. These results indicate that the implementation of the SABL approach is quite effective and successfully has helped students develop their critical thinking abilities through differentiated learning activities adjusted to their readiness levels. Additionally, the effect size analysis yielded a value of 0.87, which falls into the large effect category. This indicates that the SABL approach has a strong impact on the improvement of students' critical thinking skills.

Discussion

1. The Effectiveness of SABL Approach in Enhancing Students' Critical Thinking Skills

The results of this study indicate that the implementation of the Student Ability-Based Learning (SABL) approach contributes positively to the improvement of fourth-grade students' critical thinking skills in IPAS learning at MI Al-Hadi. This finding is demonstrated by the increase in students' posttest scores compared to the pretest results, which the significant difference was identified through the Wilcoxon Signed Rank Test, and the N-Gain score was categorized as moderate improvement. These findings suggest that learning designed based on students' prior abilities can support the development of critical thinking skills more effectively because students receive learning experiences aligned with their readiness levels and learning needs.

The improvement in students' critical thinking skills occurred because the SABL approach emphasizes instructional adaptation according to students' prior abilities. Prior to the learning process, the teacher conducted a diagnostic assessment to identify students' readiness levels and learning characteristics. Based on the assessment results, students were grouped flexibly according to their ability levels so that the teacher could provide differentiated instruction appropriate to each group. Through this process, students received learning experiences that matched their cognitive readiness, enabling them to understand the material more effectively. This finding supports the view of Wardah et al. (2025) who explained that prior knowledge significantly influences students' learning achievement because it determines their readiness to receive and process new information.

During the implementation of the learning activities, students were observed to be more active in discussions, expressing opinions, analysing problems, and completing tasks according to their respective ability levels. This condition indicates that adaptive learning can encourage students to participate more actively in constructing knowledge through social interaction and collaborative learning experiences. The findings of this study are in line with the research conducted by Yulianti & Widya Syafitri (2024), which revealed that learning tailored to students' readiness levels enhances learning engagement and classroom participation. Similarly, Jihan et al. (2023) found that the SABL approach helps students learn according to their capability levels through instructional adaptation and differentiated learning activities. The implementation of tiered assignments within the SABL approach allowed students to complete tasks progressively based on their readiness levels, thereby facilitating a more meaningful learning process. In addition, Rijal et al., (2025) explained that ability-based learning can improve both students' learning outcomes and participation in classroom activities.

Beyond confirming the effectiveness of ability-based instruction, this study offers several distinct scientific contributions to the existing literature (Habsy et al., 2023; Rijal et al., 2025). First, unlike previous studies that generally implemented SABL as a form of general differentiated instruction, this study has systematically integrated diagnostic assessment, flexible ability grouping, tiered worksheets (LKPD berjenjang), and structured scaffolding into a coherent instructional framework specifically designed for developing critical thinking skills (Jihan et al., 2023; Wardani & Darmawan, 2024). Second, while earlier research has predominantly examined the impact of SABL on general learning outcomes, academic achievement, or classroom participation, the present study has provided concrete quantitative evidence of its effectiveness in fostering higher-order critical thinking components, such as problem identification and causal reasoning within IPAS learning. Third, this study has extended the empirical application of SABL to the context of Islamic primary education (Madrasah Ibtidaiyah), an area that has received limited attention despite its highly heterogeneous student readiness and diverse educational backgrounds (Rahmah et al., 2025; Wardah et al., 2025).

Crsucially, the findings indicate that the effectiveness of the SABL approach does not merely stem from the structural grouping of students according to their initial ability alone (Jihan et al., 2023), rather, the substantial improvement in critical thinking skills is driven by a dynamic, integrated instructional cycle: a data-driven diagnostic assessment maps student readiness, which then informs flexible grouping; this grouping enables the

precise delivery of tiered learning tasks, which are systematically supported by gradual, adaptive scaffolding throughout the learning process (Comedia et al., 2025; Wardah et al., 2025). This integrated sequence operationalizes the "mechanism of success" behind the intervention, ensuring that students are neither under-challenged nor cognitively overwhelmed, thereby allowing them to progressively construct complex analytical skills according to their cognitive readiness(Rijal et al., 2025).

2. Theoretical and Pedagogical Implications in Madrasah Ibtidaiyah Context

The differentiated learning process implemented through the SABL approach has contributed to the development of students' critical thinking skills. These findings support the differentiated instruction theory proposed by Carol Ann Tomlinson, which emphasizes that learning activities should be adjusted to students' readiness levels, interests, and learning profiles. Through differentiated learning experiences, students are able to participate more actively and meaningfully in the learning process according to their individual capacities (Wardani & Darmawan, 2024). Students with higher abilities are provided with more complex tasks requiring analysis, reasoning, and problem-solving activities, whereas students with lower abilities receive more intensive guidance and scaffolding during the learning process. Theoretically, the success of this instructional framework strongly reinforces the core tenets of social constructivism and Vygotsky's Zone of Proximal Development (ZPD) (Comedia et al., 2025). In a traditional, uniform classroom, instructions often miss the students' ZPD—either being too advanced, which triggers cognitive anxiety, or too basic, which induces disengagement (Rahmah et al., 2025). The SABL approach directly addresses this pedagogical flaw by transforming the ZPD from a theoretical concept into an operational classroom reality through tiered tasks and adaptive scaffolding. By matching the complexity of IPAS tasks with individual readiness levels, this study demonstrates that critical thinking skills are not fixed student traits, but cognitive capacities that expand when provided with the appropriate level of temporary teacher support and structured peer interaction (Yulianti & Widya Syafitri, 2024).

Pedagogically, these findings carry vital implications for the distinctive context of Islamic primary education (Madrasah Ibtidaiyah)(Wardah et al., 2025). Students entering Madrasah Ibtidaiyah typically exhibit a highly pronounced disparity in academic backgrounds, cognitive styles, and foundational literacy (Rahmah et al., 2025). Implementing a "one-size-fits-all" curriculum in such a heterogeneous environment inadvertently perpetuates educational inequity, as lower-ability students are left behind while higher-ability students remain under-challenged (Wardani & Darmawan, 2024).

The implementation of SABL offers a practical paradigm shift toward pedagogical equity and inclusivity. It provides a structured methodology for teachers to accommodate diverse learner needs without compromising the rigor required to develop higher-order thinking skills. Therefore, the SABL framework serves as an essential strategic model for Madrasah teachers to cultivate a more adaptive, supportive, and intellectually inclusive learning environment (Sarina et al., 2024; Wardah et al., 2025).

The findings of this study also demonstrate that IPAS learning integrated with students' real-life experiences can facilitate the development of critical thinking skills more effectively. IPAS learning requires students to observe, analyse, and solve problems related to everyday phenomena. Therefore, learning activities designed through the SABL approach provide students with opportunities to connect conceptual understanding with real-world situations. According to Anggraeni et al., (2022), critical thinking skills develop through learning activities that encourage students to analyse problems, evaluate information, and provide logical reasoning. Similarly, Sarina et al., (2024) explained that contextual learning helps students understand concepts more meaningfully because students can relate instructional materials to their surrounding environment and daily experiences.

Nevertheless, this study still has several limitations. The research involved only one class with a relatively limited sample size, which restricts the generalization of the findings to broader educational contexts. In addition, the study employed a one-group pretest-posttest design without a control group, making it difficult to compare the effectiveness of the SABL approach with other learning approaches directly. The duration of the study was also relatively short, so the long-term impact of the SABL approach on students' critical thinking skills could not yet be fully observed. Therefore, future studies are expected to involve larger samples, include control groups, and be conducted over longer periods to provide more comprehensive findings regarding the effectiveness of the Student Ability-Based Learning approach.

CONCLUSION

This study demonstrates that the implementation of the Student Ability-Based Learning (SABL) approach effectively enhances fourth-grade students' critical thinking skills in IPAS learning within the Madrasah Ibtidaiyah context. The transformation of students' critical thinking capacities is not merely reflected in statistically significant post-intervention gains, but is fundamentally driven by the systematic operationalization of an integrated instructional cycle. By shifting away from uniform instruction, the SABL framework successfully accommodates heterogeneous learner

readiness through data-driven diagnostic assessment, flexible ability grouping, tiered learning tasks, and continuous adaptive scaffolding. This structured approach enables students to actively engage in problem identification, information analysis, and causal reasoning without experiencing excessive cognitive overload, thereby creating a more meaningful and intellectually inclusive learning environment.

Beyond confirming the general efficacy of ability-based pedagogies, this study offers distinct scientific and practical contributions to the existing educational literature. Theoretically, it provides a concrete, empirical model of how Vygotsky's Zone of Proximal Development (ZPD) and Carol Ann Tomlinson's differentiated instruction theory can be systematically unified into a functional classroom sequence to target higher-order cognitive skills rather than basic academic achievement. Practically and contextually, this research provides a vital, scalable paradigm for educators in Islamic primary education. It offers a rigorous yet adaptive pedagogical strategy to resolve the pervasive issue of wide student background disparities, achieving true educational equity by ensuring that all students receive appropriate cognitive challenges tailored strictly to their developmental stages.

Nevertheless, despite these promising outcomes, certain methodological limitations must be acknowledged to guide future investigations. This study was bounded by a pre-experimental, single-group design involving a relatively small sample size (n = 33) in one specific institutional setting, which inherently restricts the immediate generalizability of the findings and limits the isolation of external maturation factors. Furthermore, the short-term duration of the five-meeting intervention precludes any definitive conclusions regarding the long-term retention of the developed critical thinking skills. To address these limitations, future research should transition toward employing randomized controlled trials or quasi-experimental designs with parallel control groups, utilizing larger and more diverse student populations across multiple madrasahs, and conducting longitudinal evaluations to map the sustained cognitive impacts of the SABL framework over time

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