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The Implementation of Science Process Skills in Grade 5 IPAS Learning: A Case Study in Banda Aceh

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Abstract

The Merdeka Curriculum positions science and social studies (IPAS) learning not only as the mastery of content knowledge but also as the development of science process skills as a foundation for students' scientific thinking. This study aims to describe the instillation of science process skills in elementary IPAS learning during the planning and implementation stages and to identify the challenges teachers face. This study employed a qualitative case study design. The participants consisted of three fifth-grade teachers from three elementary schools in Banda Aceh. Data were collected through classroom observations, structured interviews, and documentation and analyzed descriptively, supported by simple percentage analyses to strengthen the findings.

The results show that six science process skill indicators observing, questioning and predicting, planning and conducting investigations, processing and analyzing data and information, evaluating and reflecting and communicating results have been implemented in IPAS learning, although not yet optimally integrated. At the planning stage, several indicators were not systematically incorporated into lesson plans. During classroom implementation, observing and questioning activities were more frequently facilitated, while investigation planning, data analysis, and reflective evaluation were less consistently implemented due to limited instructional time. Differences in implementation among teachers were influenced by time constraints, limited learning facilities and media, variations in students' abilities, and difficulties in designing process-based assessments.

Keywords: science process skills; IPAS learning; Merdeka Curriculum; elementary school

A. Introduction

Science and Social Studies (IPAS) learning at the elementary school level under the Merdeka Curriculum is designed to integrate Natural Sciences (IPA) and Social Sciences (IPS). In previous curricula, IPA and IPS were taught as separate subjects however, under the Merdeka Curriculum, both are combined into a single integrated subject known as IPAS (Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, 2022). This integration is based on the consideration that elementary students tend to perceive phenomena holistically; therefore, learning that simultaneously connects natural and social aspects is more aligned with their cognitive developmental stage. Through this integrated approach, IPAS is not only focused on conceptual mastery but also on developing scientific thinking through contextual, meaningful learning experiences.

In the Learning Outcomes (CP) of IPAS Phase C, the instructional structure consists of two main elements: conceptual understanding and process skills (Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, 2022). The conceptual component emphasizes mastery of concepts and the interrelationships between natural and social phenomena. In contrast, the process skills component includes the ability to observe phenomena, formulate questions, plan and conduct simple investigations, process and present data, and systematically communicate findings. Thus, process skills do not represent the entirety of the CP; rather, they constitute one of the primary elements explicitly formulated within the IPAS learning framework.

Conceptually, Science Process Skills (SPS) refer to a set of scientific abilities that enable students to construct knowledge through evidence-based inquiry. According to Rodger W. Bybee (2020), the development of process skills forms the foundation of modern science education, positioning students as active agents in constructing understanding through observation, reasoning, and reflection. Similarly, the science literacy framework developed by the Organisation for Economic Co-operation and Development (2019; 2022) emphasizes that scientific literacy encompasses not only conceptual knowledge but also the ability to interpret data and make evidence-based decisions. This perspective highlights the central role of process skills in fostering students' scientific thinking.

Although SPS have traditionally been developed within the context of science (IPA) instruction, their application has been expanded within IPAS under the Merdeka Curriculum. The distinction lies in the scope and context of implementation. In IPA, science process skills are generally focused on experiments and the observation of specific natural phenomena. In contrast,

within IPAS, these skills are also applied to analyze social phenomena related to the environment, human interaction, and societal dynamics (Suryani et al., 2023). Therefore, SPS in IPAS are contextual and integrative, as they are employed to understand both natural and social realities simultaneously.

In classroom practice, process skills in IPAS can be operationalized through various activities, such as environmental observation, analysis of socio-ecological events, data-driven discussions, and simple investigations that integrate natural and social dimensions. For example, in learning about environmental change, students not only observe natural phenomena but also analyze their impacts on community life. Such activities demonstrate that SPS in IPAS is not limited to laboratory experiments; rather, it encompasses scientific reasoning processes embedded in real-life contexts.

Several studies have shown that science process skills-based learning improves scientific literacy, critical thinking, and student engagement at the elementary level (Nurhayati et al., 2021; Fauziah, 2022; Jannah, 2025). However, most of these studies focus on science (IPA) as a separate subject. Research specifically examining the cultivation of process skills within IPAS as an integrated subject in the Merdeka Curriculum remains relatively limited.

On the other hand, various findings indicate that the implementation of science process skills in elementary classrooms has not yet been fully optimal. Learning practices tend to remain teacher-centered, limiting students' opportunities to engage in scientific activities such as observing, questioning, investigating, and communicating findings (Hidayanti et al., 2022; Sari et al., 2022). This condition reflects a gap between the process skills component mandated in the IPAS Learning Outcomes and actual classroom practice.

Teachers play a crucial role in integrating process skills into IPAS instruction at both the planning and implementation stages. Systematic lesson planning serves as the foundation for designing activities that position students in authentic scientific situations, thereby enabling optimal development of process skills. Inadequate planning may result in procedural learning that provides limited opportunities for exploration and critical thinking. Meanwhile, the Merdeka Curriculum emphasizes a balance between content mastery and the development of scientific thinking processes.

Previous studies have generally focused either on the implementation of science process skills during instruction or on the effects of specific instructional models on students' development of these skills. However, comprehensive analyses examining the integration of process skills from the planning stage through instructional implementation within IPAS under the Merdeka Curriculum remain scarce. Therefore, this study aims to describe

the integration of science process skills in Grade V IPAS learning at the elementary level, focusing on both the planning and implementation stages, and to identify the challenges teachers face in implementing these skills.

B. Research Methods

This study employed a descriptive qualitative approach with a case study design. It aimed to describe how Science Process Skills (SPS) were integrated into both the planning and implementation stages of IPAS learning at the elementary school level. The research was conducted in three elementary schools in Banda Aceh that have implemented the Merdeka Curriculum. The research participants consisted of three Grade V teachers who were directly involved in IPAS instruction.

The analysis focused on two main aspects: the integration of science process skills at the lesson planning stage and their implementation during classroom instruction. In addition, the study examined the challenges faced by teachers and their implications for the implementation of the Merdeka Curriculum at the elementary school level.

Data were collected through classroom observations, structured interviews with teachers, and documentation analysis of teaching modules and IPAS instructional materials. Observations were conducted to identify the extent to which science process skills were implemented during classroom activities, while interviews were used to explore the challenges encountered by teachers in planning and implementing process skills-based instruction. Documentation served as supporting data to strengthen the findings obtained from observations and interviews. The data were analyzed using descriptive qualitative analysis techniques, involving data reduction, data display, and conclusion drawing. To clarify the level of implementation for each science process skill indicator, the data were also presented in percentage form.

C. Result and Discussion

The findings were obtained through classroom observations, teacher interviews, and document analysis of IPAS lesson plans. The results indicated that Science Process Skills (SPS) had been accommodated in Grade V lesson planning however, their integration was not evenly distributed across all indicators. This suggests that although teachers normatively referred to the process skills component in the Phase C IPAS Learning Outcomes, its implementation in planning documents remained partial.

The results of the lesson planning observation are presented in Diagram 1.

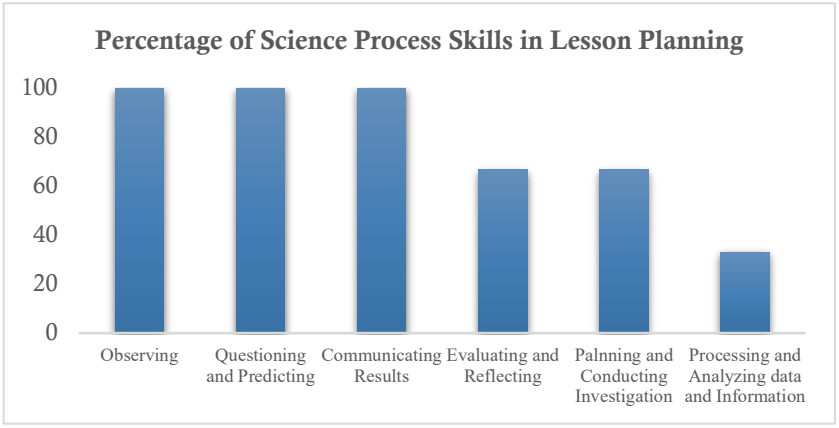

Diagram 1.
Science Process Skills in Lesson Planning

Diagram 1 shows that at the planning stage, basic process skill indicators such as observing, evaluating and reflecting, and communicating findings demonstrated relatively high levels of implementation. In contrast, indicators requiring more complex scientific processes, such as planning and conducting investigations and processing and analyzing data, showed lower percentages. This pattern indicates that IPAS lesson planning still emphasizes the initial and final stages of the learning process, while the stages involving data processing and analysis central components of evidence-based science process skills have not been systematically strengthened.

The predominance of the observing indicator suggests that teachers tended to initiate instruction with concrete and contextual activities, such as observing images, videos, or phenomena in the surrounding environment. Observing is indeed foundational within science process skills, as it serves as the entry point for students to construct preliminary understanding of a phenomenon (Sani, 2019). However, when this stage is not followed by structured data processing and interpretation, learning risks remaining at the level of surface exploration without progressing toward evidence-based knowledge construction.

The low percentage of the data processing and analysis indicator indicates that lesson plans had not systematically designed activities guiding students to compare findings, identify cause-and-effect relationships, or draw conclusions based on evidence. According to the OECD science literacy framework (2022), the ability to interpret and evaluate data constitutes the core of modern scientific literacy. Within the integrative context of IPAS, data analysis becomes even more essential, as students are expected not only to observe natural phenomena but also to understand their implications for social life and community environments.

Interview findings further reinforced these results. One teacher stated:
"In the teaching module, I usually include observing activities and discussions, but the data analysis section is not yet designed in detail. Students often directly present their observations without processing the data first." (G1)

This statement indicates that lesson planning tended to emphasize initial activities and reporting outcomes, while the stages of data processing and interpretation were not yet systematically structured. Another teacher explained:
"Designing a complete investigation activity requires more time and preparation. Sometimes we adjust it to classroom conditions and time limitations." (G2)

These excerpts suggest that limitations in designing investigation and analysis stages were not solely conceptual but were also influenced by practical constraints in instructional management. Therefore, the challenges in planning SPS integration within IPAS are both pedagogical and contextual in nature.

These findings indicate that in IPAS lesson planning, SPS were still perceived primarily as a series of activities (e.x observing and discussing), rather than as a coherent and continuous scientific process. However, within inquiry-based learning approaches, as proposed by Bybee (2020), each stage from observation to analysis and communication must be systematically designed to allow students to experience the full scientific cycle. The imbalance in the investigation and data analysis indicators suggests that lesson planning has not yet fully reflected the characteristics of IPAS under the Merdeka Curriculum, which emphasizes a balance between conceptual understanding and scientific processes.

When viewed from the perspective of integrating natural and social sciences within IPAS, the limited planning at the data analysis stage may also indicate that teachers are still in the process of adapting to the integrative nature of the subject. In IPAS, scientific processes are not only used to understand natural phenomena but also to analyze social issues, such as human environment interactions. Therefore, investigation planning should extend beyond simple experiments to include the analysis of socio-ecological events relevant to students' daily lives.

Overall, the analysis of lesson planning indicates that science process skills have been incorporated into IPAS instruction; however, their implementation remains focused on basic skills and has not yet fully promoted higher-order analytical thinking. This finding aligns with Zubaidah (2021), who argues that teachers tend to find it easier to design instructional activities targeting basic skills than higher-order thinking skills. This condition reflects a gap between the curriculum's expectations, particularly

the Phase C IPAS Learning Outcomes emphasizing comprehensive scientific processes, and actual instructional planning practices in schools.

The results of the classroom implementation stage are presented in Diagram 2.

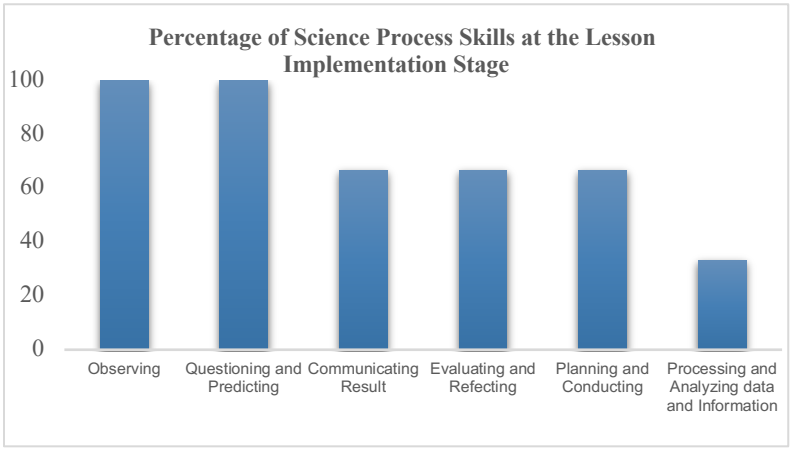

Diagram 2.
Science Process Skills at the Lesson Implementation Stage

Diagram 2 indicates that during instructional implementation, Science Process Skills (SPS) appeared to be more developed compared to the planning stage. Students were more actively engaged in observing, questioning, and predicting activities. This suggests that, in classroom practice, teachers attempted to create active and participatory learning environments. However, the indicators related to processing and analyzing data did not emerge optimally, largely due to time constraints and limited instructional resources.

The limited occurrence of data processing and analysis indicators suggests that learning activities remained concentrated at the initial exploration stage and did not fully reach the level of evidence-based reasoning. According to Bybee (2020), the essence of science learning lies not merely in observing or conducting experiments, but in students' ability to interpret data and draw logical conclusions. When students are not systematically guided to process and analyze data, the development of scientific literacy and scientific thinking skills becomes less optimal.

The difference in the implementation of science process skills between the planning and instructional stages reflects a gap between instructional design and classroom practice. Theoretically, systematic lesson planning should serve as the primary foundation for ensuring that science process skills are implemented in a structured manner (Fauziah, 2022). However, the findings of this study indicate that, in practice, teachers tended to be more

flexible and spontaneous in applying basic process skills, whereas higher-level skills—requiring carefully designed activities and assessment strategies—were less consistently implemented.

Interview findings further supported this conclusion. One teacher stated, "Students are enthusiastic during observation and discussion activities, but when we move to data analysis, instructional time is often insufficient." (G3). This statement suggests that time management issues and the complexity of analytical tasks constitute limiting factors in the comprehensive implementation of science process skills. These findings are consistent with previous studies (Rahmawati et al., 2023; Sari et al., 2022), which report that limited time, insufficient facilities, and teacher readiness are significant barriers to the full integration of science process skills in elementary classrooms.

In addition, teachers' difficulties in designing process-based assessments indicate that the implementation of science process skills has not yet been fully integrated into the instructional evaluation system. Process-oriented assessment is a crucial component in ensuring that students not only understand concepts but also apply scientific procedures reflectively. This condition highlights the urgent need to strengthen teachers' pedagogical competence in designing instruction and assessment grounded in science process skills.

Overall, the findings of this study reveal not only a gap between the planning and implementation of IPAS instruction but also indicate that the development of science process skills remains at a foundational level. These results reinforce previous research emphasizing the importance of systematic lesson planning and adequate facility support as fundamental foundations for developing students' science process skills (Nurhayati et al., 2021; Fauziah, 2022).

D. Conclusion

This study concludes that the integration of Science Process Skills (SPS) in Grade V IPAS learning has been initiated at both the planning and implementation stages, yet remains inconsistent and suboptimal. Instructional planning predominantly emphasized basic process skills, while higher-order skills were not systematically designed. However, classroom implementation showed greater student engagement, constraints in time, facilities, and pedagogical readiness limited alignment with planned instruction. This gap indicates that SPS integration in IPAS is still at a foundational level and has not fully supported the development of scientific literacy as expected in the Phase C IPAS Learning Outcomes of the Merdeka Curriculum. Therefore, strengthening teachers' competence in designing process-based instruction and assessment, supported by adequate facilities,

effective time management, and targeted professional development, is essential to foster deeper scientific thinking in IPAS learning.

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