



The Implementation of Scientific Literacy in IPAS Learning among Grade V Students at Primary School

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ABSTRACT

This study aims to describe the implementation of scientific literacy in IPAS (Integrated Natural and Social Science) learning among Grade V students at SD YPK Yeflio, Sorong Regency. The research employed a qualitative approach with descriptive methods, designed to understand phenomena that do not require quantification. Data were collected through three techniques: structured observation, in-depth interviews, and documentation. Research subjects comprised 12 Grade V students and one Grade V classroom teacher at SD YPK Yeflio, Sorong Regency. Data were collected from 14 to 28 February 2025. Data analysis followed the qualitative data analysis model proposed by Bogdan and Biklen, encompassing data organization, categorization, synthesis, pattern identification, and interpretation. Data credibility was verified through triangulation, extended observation, and member-checking. The findings indicate that (1) students' scientific literacy is moderately developed and is influenced by two interacting factor categories: external factors, namely the introduction of literacy practices in the family and community environment from an early age; and internal factors within individual students, particularly low reading interest in relation to science literacy content; (2) teachers must continuously improve the quality of the teaching

and learning process to cultivate students' interest and motivation in scientific literacy. The findings contribute empirical evidence on the contextual conditions of science literacy implementation in primary schools in remote West Papua, providing implications for instructional improvement and school literacy program development.

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INTRODUCTION

The 21st century is characterized by the rapid advancement of science and technology, generating new demands on educational systems worldwide. Among the critical competencies that individuals are required to develop in this era is scientific literacy, defined as the capacity to engage with scientific knowledge and technology in understanding material, cultural, and intellectual dimensions of contemporary life (Werdiningsih, 2021). Scientific literacy encompasses more than the passive reception of scientific facts; it involves the ability to ask questions, identify evidence, draw conclusions, and engage in informed scientific discourse about issues relevant to daily life (Pratiwi et al., 2019; Novita et al., 2021).

In the Indonesian educational context, scientific literacy has become an increasingly prominent policy concern, particularly following Indonesia's consistently below-average performance on the Programme for International Student Assessment (PISA). PISA 2022, which assessed approximately 690,000 students from 81 countries, recorded Indonesia's science literacy score at 383 points, below the OECD average of 485 (OECD, 2023). These outcomes reflect structural challenges in science education at the primary level, including limited instructional variation, insufficient promotion of process-based scientific inquiry, and low student engagement with science literacy activities (Novianti & Alwi, 2024; Rorimpandey et al., 2024).

Within the framework of the Merdeka Curriculum, science and social studies at the primary school level have been integrated into a single subject, IPAS (Ilmu Pengetahuan Alam dan Sosial: Integrated Natural and Social Science). IPAS is designed to provide a holistic, thematic, and contextually meaningful educational experience that fosters students' scientific and social understanding simultaneously (Wulandari et al., 2023; Atmijaya et al., 2023). Science literacy within IPAS learning is expected to promote students' capacity to observe, classify, measure, communicate, predict, and conclude, all of which are fundamental scientific process skills for primary education (Rusli et al., 2025).

Despite these curricular intentions, the conditions for science literacy implementation in primary schools in remote or underserved regions of eastern Indonesia remain insufficiently documented. Schools such as SD YPK Yeflio in Sorong Regency face particular challenges, including limited facilities, constrained access to diverse learning resources, and low student reading interest, all of which may impede effective science literacy development. Hayaturraiyana (2019) emphasizes that cultivating a school science literacy culture can enhance students' literacy capacity through activities including observation, laboratory work, environmental conservation, outdoor learning, and emergency preparedness simulations. Understanding the conditions under which science literacy is implemented in such contexts is essential for informing contextually appropriate and pedagogically grounded instructional improvement.

This study was conducted to describe the implementation of scientific literacy in IPAS learning among Grade V students at SD YPK Yeflio, Sorong Regency, with particular attention to the internal and external factors influencing students' engagement with science literacy and the instructional strategies employed by the classroom teacher to promote science literacy development.

METHODS

Research Design and Approaches General

This research employed a qualitative approach with a descriptive design. Qualitative research, as defined by Sugiyono (2018), is a research methodology grounded in philosophical inquiry that investigates natural conditions in which the researcher serves as the primary instrument; it emphasizes meaning and understanding rather than quantification. The descriptive qualitative approach was selected because the study aimed to understand, analyze, and describe the natural phenomenon of science literacy implementation as it occurs in the actual classroom environment, without experimental manipulation.

Data analysis followed the qualitative data analysis model as articulated by Bogdan and Biklen (as cited in Moleong, 2018), which involves working systematically with data through the stages of organization, categorization, synthesis, pattern identification, and interpretation. Data credibility was established through three credibility verification techniques as outlined by Sugiyono (2009): triangulation (cross-verification of data across observation, interview, and documentation sources), extended observation (prolonged engagement at the research site), and member-checking (validation of findings with research subjects).

Research Setting, Participants, and Data Collection

The research was conducted at SD YPK Yeflio, Sorong Regency, West Papua Province, Indonesia, from 14 to 28 February 2025. Research subjects comprised 12 Grade V students and one Grade V classroom teacher (Mr. Darius Felis, A.Ma.). The students were selected purposively to represent a range of science literacy engagement patterns observed in the classroom. Data were collected through three complementary techniques: (1) structured observation of classroom learning activities, documenting teacher and student behaviours in relation to six science process skill dimensions: observing, classifying, measuring, communicating, predicting, and concluding; (2) in-depth semi-structured interviews with the classroom teacher and all 12 students

participants, covering 10 interview themes aligned with the PISA scientific literacy framework (explaining phenomena scientifically, evaluating and designing scientific inquiry, and interpreting data and evidence); and (3) documentation in the form of classroom artifacts, lesson materials, and photographic records.

RESULTS AND DISCUSSION

Results

Teacher Observation Results

Observation of the Grade V classroom teacher at SD YPK Yeflio revealed a teaching practice characterized by consistent use of science process skills across all lesson units. The teacher provided opportunities for students to engage in inquiry-based activities; formed small learning groups to promote collaborative discussion; employed differentiated instruction; and regularly used digital resources, including PowerPoint presentations and YouTube videos, to supplement instruction. End-of-lesson reflection and post-tests were conducted routinely to assess student understanding and monitor learning progress. Summary findings from classroom observations are presented in Table 1.

Table 1. Summary of Classroom Observation Findings: Teacher and Student Science Literacy Practice

Observation Aspect	Teacher Practice (YES responses)	Student Limitations (NO responses)
Science process skills	Used systematically in each lesson unit; students engaged in observing, classifying, measuring, communicating, predicting, and concluding.	Some indicators were not fully met (e.g., quantitative observation, systematic classification ordering).
Student grouping	Regularly formed small learning groups to reduce passive learning and encourage peer discussion.	Students occasionally needed guidance to define clear classification criteria.
Reflection activities	Reflective closure conducted after each lesson; teacher monitored individual learning pace.	Students' depth of self-reflection varied across the class.
Use of technology	PowerPoint presentations, YouTube videos, and online media used to supplement instruction.	Limited school infrastructure occasionally constrained consistent technology use.

Library use	The school library provided IPAS reference books; students were directed to the library during free periods.	Students' independent use of the library was infrequent without teacher direction.
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Teacher Interview Results

In-depth interviews with the Grade V teacher yielded rich contextual data regarding the implementation of scientific literacy in IPAS learning. The teacher demonstrated a well-developed understanding of scientific literacy as a pedagogical orientation, citing practical daily-life examples including the observation of material state changes in cooking and the conversion of organic waste into compost. The teacher consistently applied differentiated instruction, organizing students into small groups for collaborative inquiry tasks, and made regular use of technology-based resources to diversify learning stimuli. Key themes from the teacher interview are summarized in Table 2.

Table 2. Summary of Teacher Interview Findings on Scientific Literacy Implementation

No.	Interview Question	Summary of Teacher Response
1	How is scientific literacy implemented in daily life?	Daily examples cited: observing material changes during cooking; recycling organic waste into compost.
2	What strategies are used to improve students' science literacy?	YouTube, Google, and online media used as instructional guides; differentiated instruction applied through student groupings.
3	How is scientific literacy promoted among students?	Students exposed to science posters and educational videos in addition to formal classroom lessons.
4	How is student progress in science literacy assessed?	Learning journals were maintained; post-lesson posttests were administered after each session.
5	What challenges are faced in implementing science literacy?	Limited school facilities and infrastructure; low student reading interest; need for patience and sustained engagement.
6	What are the expectations for science literacy development?	Sustained student-centered approaches, consistent use of engaging instructional methods, and cultivating students' critical thinking in science.

Student Interview Results

Interviews with 12 Grade V students across 10 structured questions

aligned with the PISA scientific literacy framework revealed a moderate but developing engagement with science literacy activities. Across three PISA-aligned dimensions, the following patterns emerged: (1) Explaining phenomena scientifically: Most students demonstrated a basic awareness of natural phenomena such as earthquakes, weather patterns, and material changes, primarily derived from family guidance, television, and classroom instruction rather than formal scientific inquiry. Only a small number of students had participated in structured disaster preparedness simulations. (2) Evaluating and designing scientific inquiry: All students reported having participated in at least one hands-on science activity at school, including growing and observing plants, making clouds in a cup, creating floating eggs, making oil and water density demonstrations, and experimenting with lime water reactions. These activities reflect meaningful exposure to basic scientific investigation methods. (3) Interpreting data and evidence: Students demonstrated a strong commitment to environmental literacy actions, including composting, water conservation, waste sorting, and recycling. Reading activities were largely teacher-directed, occurring primarily during IPAS lessons and scheduled library visits. All 12 students confirmed that science literacy activities increased their learning interest and active participation and that technology, particularly smartphones and online resources, was used to support IPAS learning both in and outside school. The school library was unanimously identified as a resource that supports science literacy through the provision of IPAS reference materials.

Discussion

The findings of this study describe a school environment in which science literacy is being actively, if partially, implemented within IPAS learning. The two-factor model that emerges from the data, external factors (early literacy exposure in family and community environments) and internal factors (individual student motivation and reading interest), is consistent with the theoretical framework articulated by Hija (2018) and substantiated by the

determinant factor analysis conducted by Rorimpandey et al. (2024) in the context of elementary science education. External factors, particularly family literacy environments, are recognized in the international literature as foundational to students' early science literacy acquisition; Sun and Chan (2024), in a Scopus-indexed study published in the *International Journal of Science Education*, demonstrated that language and reading skills in early primary school serve as distinct developmental pathways to later science literacy, underscoring the importance of out-of-school literacy environments.

The observation and interview data converge on a central finding: the classroom teacher at SD YPK Yeflio demonstrates a consistent commitment to science literacy pedagogy, employing diversified instructional strategies including group learning, technology integration, reflective practice, and differentiated instruction. These strategies align with the competencies identified by Pratiwi et al. (2019) as essential for 21st-century science education in Indonesia and reflect the PISA science literacy framework's emphasis on inquiry, evidence-based reasoning, and contextual knowledge application. The finding that students engage in concrete hands-on science activities, environmental observation, and peer discussion is consistent with Hayaturraiyani's (2019) recommendation that science literacy culture should be embedded in school-wide activities encompassing observation, environmental stewardship, and collaborative inquiry.

At the same time, the study identifies persistent constraints on science literacy implementation: low student reading interest, limited school facilities and infrastructure, and the absence of systematic disaster literacy programs (as evidenced by the majority of students not having participated in earthquake preparedness simulations). These constraints are characteristic of primary schools in remote or resource-constrained settings in eastern Indonesia and echo the concerns raised by Novita et al. (2021) in their meta-analysis of science literacy in Indonesian schools, which documented a systemic gap between policy aspirations and implementation realities at the classroom level.

The contextual contribution of this study lies in its empirical

documentation of science literacy implementation in a school serving a geographically isolated community in Sorong Regency, West Papua, a context underrepresented in the existing national and international science education literature. The findings provide an important empirical baseline for targeted literacy program development and professional development support for primary school teachers in similar contexts. Consistent with the framework proposed by Rusli et al. (2025) and Putri et al. (2025), effective elementary science literacy development requires attention to both cognitive dimensions, such as process skills and scientific reasoning, and contextual dimensions, including school infrastructure, teacher competence, and community literacy culture.

CONCLUSION

Conclusion

This study concludes that the implementation of scientific literacy in IPAS learning among Grade V students at SD YPK Yeflio, Sorong Regency, is at a moderate and developing stage. Two interacting factor categories shape the level of students' science literacy: external factors, encompassing early literacy exposure within family and community environments, and internal factors, primarily characterized by low student reading interest in science literacy content. The classroom teacher demonstrates consistent application of science process skills, differentiated instruction, technology-supported learning, and reflective assessment practices. Student responses confirm that science literacy activities, including hands-on experiments, environmental observation tasks, group discussions, and library-based reading, positively influence their learning engagement and motivation in IPAS.

Recommendations

Based on the findings, three recommendations are offered. First, students should be provided with more structured and self-directed opportunities to practise science literacy skills, including guided reading of age-appropriate

science texts and scaffolded inquiry tasks aligned with local environmental contexts. Second, teachers should expand their repertoire of science literacy instructional strategies and embed science literacy practices more systematically across all IPAS learning activities, not only in dedicated inquiry sessions. Third, schools should prioritize the improvement of library resources, laboratory equipment, and digital learning infrastructure, as well as organize community-based science literacy activities, including environmental observation fieldwork and disaster preparedness simulations, to strengthen the contextual relevance and engagement value of science literacy education.

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